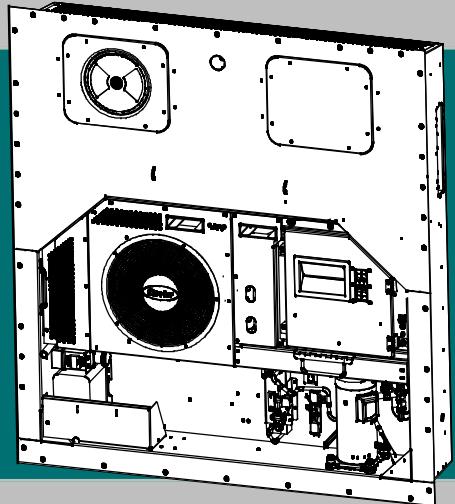
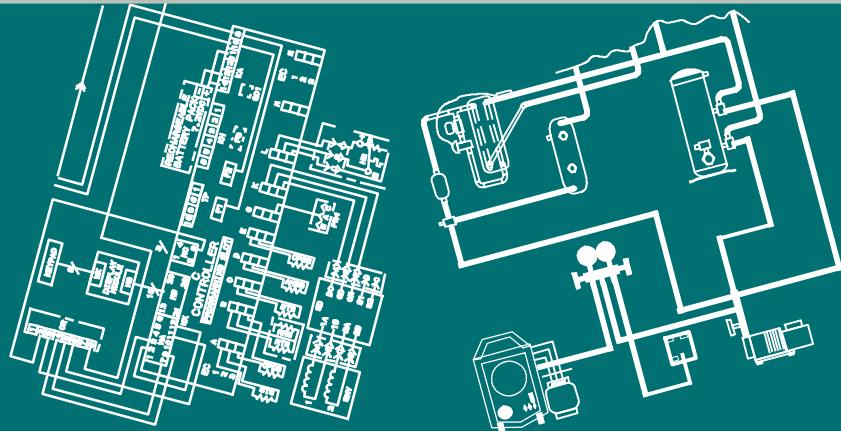




Container Refrigeration



OPERATIONS AND SERVICE MANUAL

For
69NT40-561-200 to 299

Container Refrigeration Units



OPERATIONS AND SERVICE MANUAL

For
69NT40-561-200 to 299

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SECTION 1

SAFETY SUMMARY

1.1 GENERAL SAFETY NOTICES

Installation and servicing of refrigeration equipment can be hazardous due to system pressures and electrical components. Only trained and qualified service personnel should install, repair, or service refrigeration equipment. When working on refrigeration equipment, observe all potential Danger, Warning and Caution hazards, including those shown below and on hazard labels attached to the unit.

The following general safety notices supplement specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. The general safety notices are presented in the following three sections labeled: First Aid, Operating Precautions and Maintenance Precautions. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

1.2 FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

1.3 OPERATING PRECAUTIONS

Always wear safety glasses.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

Wear appropriate personal protective equipment for the work being undertaken.

No work should be performed on the unit until all circuit breakers and start-stop switches are turned off, and power supply is disconnected.

In case of severe vibration or unusual noise, stop the unit and investigate.

1.4 MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the evaporator and condenser fans. Do not open the condenser fan grille or evaporator access panels before turning power off, disconnecting and securing the power plug.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical control switches. Tag circuit breaker and power supply to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed by qualified service personnel.

When performing any arc welding on the unit or container, disconnect all wire harness connectors from the modules in control boxes. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO₂ (never use water).

1.5 SPECIFIC HAZARD STATEMENTS

To help identify the label hazards on the unit and explain the level of awareness each one carries, an explanation is given with the appropriate consequences:

DANGER - means an immediate hazard that WILL result in severe personal injury or death.

WARNING - means to warn against hazards or unsafe conditions that COULD result in severe personal injury or death.

CAUTION - means to warn against potential hazard or unsafe practice that could result in personal injury, product or property damage.

The statements listed below are applicable to the refrigeration unit and appear elsewhere in this manual. These recommended precautions must be understood and applied during operation and maintenance of the equipment covered herein.

WARNING

EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage.

Never use air or gas mixtures containing oxygen (O₂) for leak testing or operating the product.

Charge Only With R-134a: Refrigerant must conform to AHRI Standard 700 specification.

WARNING

Beware of unannounced starting of the evaporator and condenser fans. The unit may cycle the fans and compressor unexpectedly as control requirements dictate.

WARNING

Do not attempt to remove power plug(s) before turning OFF start-stop switch (ST), unit circuit breaker(s) and external power source.

WARNING

Make sure the power plugs are clean and dry before connecting to power receptacle.

WARNING

Make sure that the unit circuit breaker(s) (CB-1 & CB-2) and the START-STOP switch (ST) are in the "O" (OFF) position before connecting to any electrical power source.

WARNING

Make sure power to the unit is OFF and power plug disconnected before replacing the compressor.

WARNING

Before disassembly of the compressor, be sure to relieve the internal pressure very carefully by slightly loosening the couplings to break the seal.

WARNING

Do not use a nitrogen cylinder without a pressure regulator.

WARNING

Do not open the condenser fan grille before turning power OFF and disconnecting power plug.

WARNING

Oakite No. 32 is an acid. Be sure that the acid is slowly added to the water. DO

NOT PUT WATER INTO THE ACID - this will cause spattering and excessive heat.

WARNING

Wear rubber gloves and wash the solution from the skin immediately if accidental contact occurs. Do not allow the solution to splash onto concrete.

WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

WARNING

Installation requires wiring to the main unit circuit breaker, CB1. Make sure the power to the unit is off and power plug disconnected before beginning installation.

CAUTION

Charge water-cooled condenser or receiver according to nameplate specifications to ensure optimal unit performance.

CAUTION

Do not remove wire harnesses from controller modules unless you are grounded to the unit frame with a static safe wrist strap.

CAUTION

Unplug all controller module wire harness connectors before performing arc welding on any part of the container.

CAUTION

Do not attempt to use an ML2i PC card in an ML3 equipped unit. The PC cards are physically different and will result in damage to the controller.

CAUTION

Pre-trip inspection should not be performed with critical temperature cargoes in the container.

CAUTION

When Pre-Trip key is pressed, economy, dehumidification and bulb mode will be deactivated. At the completion of Pre-Trip activity, economy, dehumidification and bulb mode must be reactivated.

CAUTION

When condenser water flow is below 11 lpm (3 gpm) or when water-cooled operation is not in use, the CFS switch MUST be set to position "1" or the unit will not operate properly.

CAUTION

When a failure occurs during automatic testing, the unit will suspend operation awaiting operator intervention.

CAUTION

When Pre-Trip test Auto 2 runs to completion without being interrupted, the unit will terminate pre-trip and display "Auto 2" "end." The unit will suspend operation until the user depresses the ENTER key!

CAUTION

The unit will remain in the full cooling mode as long as the EB switch is in the On position and the Mode Switch is in the Full Cool position. If the cargo can be damaged by low temperatures, the operator must monitor container temperature and manually cycle operation as required to maintain temperature within required limits.

CAUTION

Allowing the scroll compressor to operate in reverse for more than two minutes will result in internal compressor damage. Turn the start-stop switch OFF immediately.

CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

CAUTION

The scroll compressor achieves low suction pressure very quickly. Do not use the compressor to evacuate the system below 0 psig. Never operate the compressor with the suction or discharge service valves closed (front seated). Internal damage will result from operating the compressor in a deep vacuum.

CAUTION

Take necessary steps (place plywood over coil or use sling on motor) to prevent motor from falling into condenser coil.

CAUTION

Do not remove wire harnesses from module unless you are grounded to the unit frame with a static safe wrist strap.

CAUTION

Unplug all module connectors before performing arc welding on any part of the container.

CAUTION

The unit must be OFF whenever a programming card is inserted or removed from the controller programming port.

CAUTION

Use care when cutting wire ties to avoid nicking or cutting wires.

CAUTION

Do not allow moisture to enter wire splice area as this may affect sensor resistance.

SECTION 2

INTRODUCTION

2.1 INTRODUCTION

The Carrier Transicold model 69NT40- 561- 200 - 299 series units are of lightweight aluminum frame construction, designed to fit in the front of a container and serve as the container's front wall.

They are one piece, self-contained, all electric units, which include cooling and heating systems to provide precise temperature control.

The units are supplied with a complete charge of refrigerant R- 134a and compressor lubricating oil, and are ready for operation upon installation. Forklift pockets are provided for unit installation and removal.

The base unit operates on nominal 380/460 volt, 3-phase, 50/60 hertz (Hz) power. An optional autotransformer may be fitted to allow operation on nominal 190/230, 3- phase, 50/60 Hz power. Control system power is provided by a transformer which steps the supply power down to 18 and 24 volts, single phase.

The controller is a Carrier Transicold Micro- Link 3 microprocessor. The controller operates automatically to select cooling, holding or heating as required to maintain the desired set point temperature within very close limits. The unit may also be equipped with an electronic temperature recorder.

The controller has a keypad and display for viewing or changing operating parameters. The display is also equipped with lights to indicate various modes of operation.

2.2 CONFIGURATION IDENTIFICATION

Unit identification information is provided on a plate located on the back wall of the condenser section. The plate provides the unit model number, the unit serial number and the unit parts identification number (PID). The model number identifies the overall unit configuration, while the PID number provides information on specific optional equipment, factory provisioned to allow for field installation of optional equipment and differences in detailed parts.

2.3 FEATURE DESCRIPTIONS

2.3.1 Control Box

Units are equipped with an aluminum control box, and may be fitted with a lockable door.

2.3.2 Temperature Readout

The unit is fitted with suction and discharge refrigerant temperature sensors. The sensor readings may be viewed on the controller display.

2.3.3 Pressure Readout

The unit is fitted with evaporator, suction, and discharge pressure transducers. The transducer readings may be viewed on the controller display.

2.3.4 Compressor

The unit is fitted with a scroll compressor equipped with suction and discharge service connections.

2.3.5 Condenser Coil

The unit is fitted with a two- row square formed condenser coil using 7mm tubing.

2.3.6 Evaporator

The evaporator section is equipped with an electronic expansion valve (EEV).

2.3.7 Evaporator Fan Operation

Units are equipped with three- phase evaporator fan motors. Opening of an evaporator fan internal protector will shut down the unit.

2.3.8 Plate Set

Each unit is equipped with a tethered set of wiring schematics and wiring diagram plates. The plate sets are ordered using a seven- digit base part number and a two- digit dash number.

2.4 OPTION DESCRIPTIONS

Various options may be factory or field equipped to the base unit. These options are described in the following sub- paragraphs.

2.4.1 Battery

The refrigeration controller may be fitted with standard replaceable batteries or a rechargeable battery pack. Rechargeable battery packs may be fitted in the standard location or in a secure location.

2.4.2 Dehumidification

The unit may be fitted with a humidity sensor. This sensor allows setting of a humidity set point in the controller. In dehumidification mode, the controller will operate to reduce internal container moisture level.

2.4.3 USDA

The unit may be supplied with fittings for additional temperature probes, which allow recording of USDA Cold Treatment data by the integral DataCORDER function of the Micro- Link refrigeration controller.

2.4.4 Interrogator

Units that use the DataCORDER function are fitted with interrogator receptacles for connection of equipment to download the recorded data. Two receptacles may be fitted; one is accessible from the front of the container and the other is mounted inside the container (with the USDA receptacles).

2.4.5 Remote Monitoring

The unit may be fitted with a remote monitoring receptacle. This item allows connection of remote indicators for COOL, DEFROST and IN RANGE. Unless otherwise indicated, the receptacle is mounted at the control box location.

2.4.6 Quest - CCPC

Compressor- Cycle Perishable Cooling (CCPC) is a method of temperature control used during steady-state perishable cooling that cycles the compressor on and off according to supply / return air temperature conditions.

2.4.7 Communications Interface Module

The unit may be fitted with a communications interface module. The communications interface module is a slave module which allows communication with a master central monitoring station. The module will respond to communication and return information over the main power line. Refer to the ship master system technical manual for further information.

2.4.8 Autotransformer

An autotransformer may be provided to allow operation on 190/230, 3- phase, 50/60 Hz power. The autotransformer raises the supply voltage to the nominal 380/ 460 volt power required by the base unit. The autotransformer may also be fitted with an individual circuit breaker for the 230 volt power.

If the unit is equipped with an autotransformer and communications module, the autotransformer will be fitted with a transformer bridge unit (TBU) to assist in communications.

2.4.9 Gutters

Rain gutters may be fitted over the control box and recorder section to divert rain away from the controls.

2.4.10 Handles

The unit may be equipped with handles to facilitate access to stacked containers. These fixed handles are located on either side of the unit.

2.4.11 Thermometer Port

The unit may be fitted with ports in the front of the frame for insertion of a thermometer to measure supply and/or return air temperature. If fitted, the port(s) will require a cap and chain.

2.4.12 Water Cooling

The refrigeration system may be provisioned for a water- cooled condenser.

2.4.13 Back Panels

Aluminum back panels may have access doors and/or hinge mounting.

2.4.14 460 Volt Cable

Various power cable and plug designs are available for the main 460 volt supply. The plug options tailor the cables to each customer's requirements.

2.4.15 230 Volt Cable

Units equipped with an autotransformer require an additional power cable for connection to the 230 volt source. Various power cable and plug designs are available. The plug options tailor the cables to each customer's requirements.

2.4.16 Cable Restraint

Various designs are available for storage of the power cables. These options are variations of the compressor section cable guard.

2.4.17 Upper Air (Fresh Air Make Up)

The unit may be fitted with an upper fresh air makeup assembly. The fresh air makeup assembly is available with a vent positioning sensor (VPS) and may also be fitted with screens.

2.4.18 Lower Air (Fresh Air Make Up)

The unit may be fitted with a lower fresh air makeup assembly. The fresh air makeup assembly is available with a vent positioning sensor (VPS) and may also be fitted with screens.

2.4.19 Labels

Safety Instruction and Function Code listing labels differ depending on the options installed. Labels available with additional languages are listed in the parts list.

2.4.20 Controller

Two replacement controllers are available:

1. Re-manufactured - Controller is the equivalent of a new OEM controller and is supplied with a 12-month warranty.
2. Repaired - Controller has had previous faults repaired and upgraded with the latest software.

NOTE

Repaired controllers are NOT to be used for warranty repairs; only full OEM Re-manufactured controllers are to be used.

Controllers will be factory- equipped with the latest version of operational software, but will NOT be configured for a specific model number and will need to be configured at the time of installation or sale.

2.4.21 Condenser Grille

Condenser grilles are direct bolted.

2.4.22 Emergency Bypass

The optional Emergency Bypass switch (EB) functions to bypass the controller in the event of controller failure.

2.4.23 eAutoFresh

The optional eAutoFresh venting system moderates the atmospheric level inside the container unit in response to cargo respiration.

SECTION 3

DESCRIPTION

3.1 GENERAL DESCRIPTION

3.1.1 Refrigeration Unit - Front Section

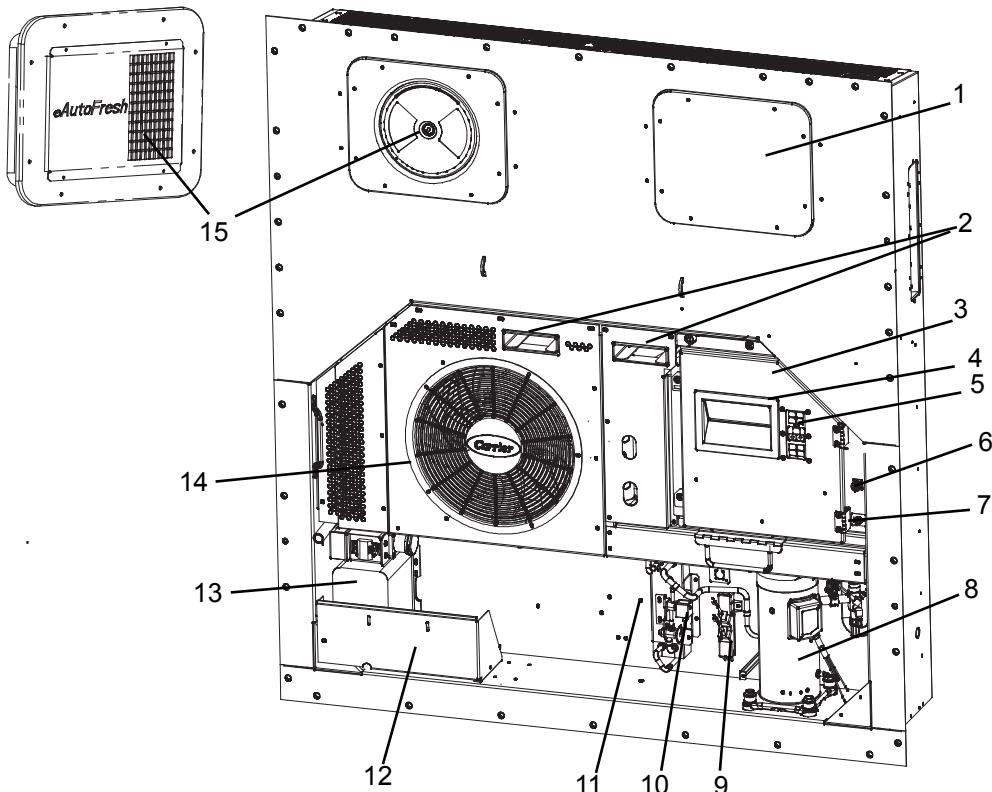
The unit is designed so that the majority of the components are accessible from the front (see **Figure 3.1**). The unit model number, serial number and parts identification number can be found on the serial plate on the back wall of the condenser section.

3.1.2 Fresh Air Makeup Vent

The function of the upper or lower makeup air vent is to provide ventilation for commodities that require fresh air circulation. A manually operated venting system is located in the upper left access panel.

The optional eAutoFresh vent system is used to moderate the atmospheric level in the container in response to cargo respiration. When transporting frozen cargo loads the vent will be closed. The upper left access panel contains the vent slide and motor assembly. It may be removed to allow entry into the evaporator section where the CO₂ sensor and drive pack are located.

Figure 3.1 Refrigeration Unit - Front Section



1. Access Panel (Evap. Fan #1)
2. Fork Lift Pockets
3. Control Box
4. Unit Display
5. Control Panel
6. Remote Monitoring Receptacle
7. Start- Stop Switch, ST
8. Compressor
9. Supply Temperature Supply/Recorder Sensor Assembly (STS/SRS)
10. Economizer
11. Ambient Temperature Sensor (AMBS)
12. Power Cables and Plug (Location)
13. Autotransformer
14. Condenser Grille
15. Upper Fresh Air Makeup Vent Panel (Evap. Fan #2)

3.1.3 Evaporator Section

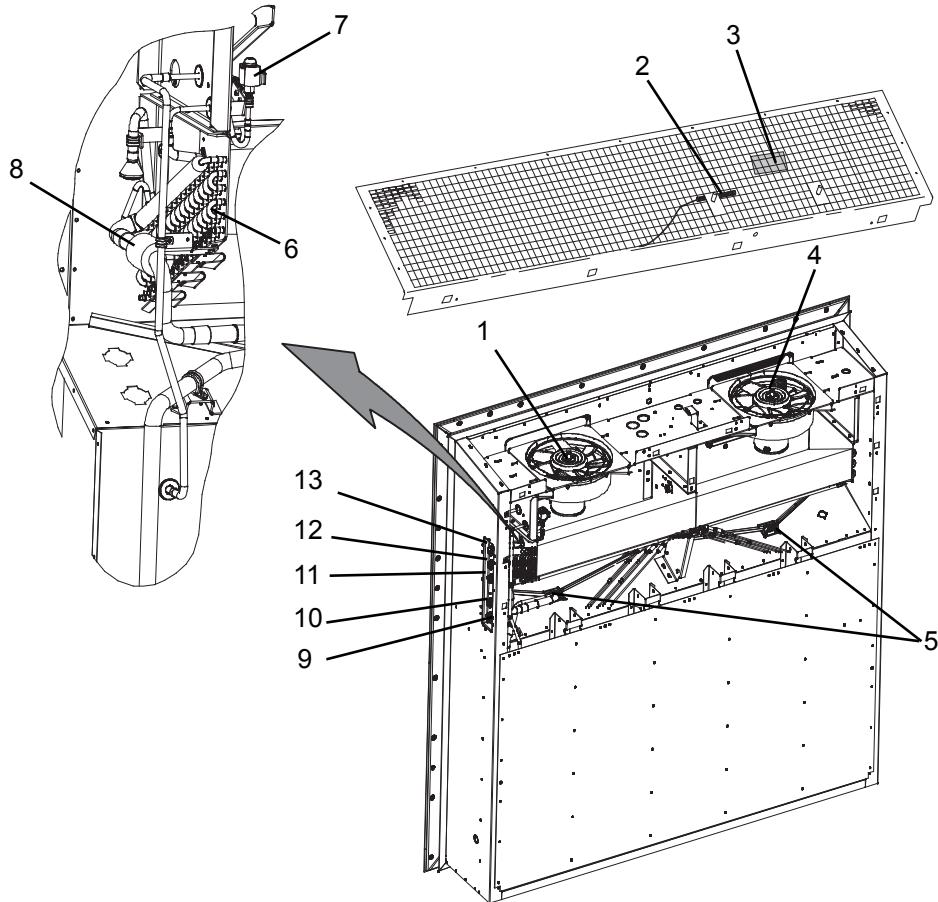
The evaporator section is shown below. The evaporator fans circulate air through the container by pulling it in the top of the unit, directing it through the evaporator coil where it is heated or cooled, and discharging it at the bottom.

If the unit is equipped with eAutoFresh, system components are mounted in addition to the standard refrigeration unit components. The stepper motor component is

installed in the vent; the air filter, CO₂ sensor, stepper motor drive and CO₂ sensing lines are installed on the rib of the upper grill.

Most evaporator components are accessible by removing the upper rear panel (as shown in the illustration) or by removing the evaporator fan access panels (see [Figure 3.2](#)).

Figure 3.2 Evaporator Section



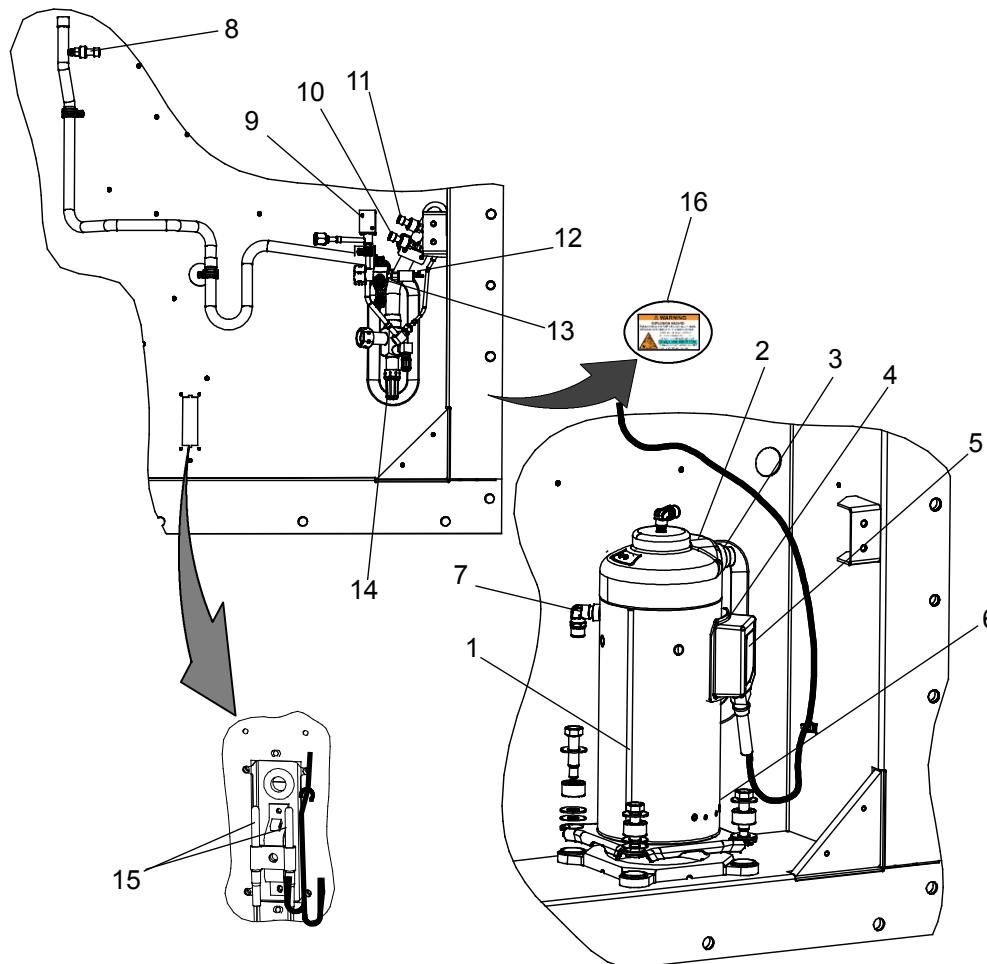
1. Evaporator Fan Motor #1 (EM1)
2. Return Recorder Sensor/Temperature Sensor (RRS/RTS)
3. Humidity Sensor (HS)
4. Evaporator Fan Motor #2 (EM2)
5. Evaporator Coil Heaters (Underside of Coil)
6. Evaporator Coil
7. Electronic Expansion Valve (EEV)
8. Evaporator Temperature Sensors (Location) (ETS1 & ETS2)
9. Interrogator Connector (Rear) (ICR)
10. USDA Probe Receptacle PR2
11. USDA Probe Receptacle PR1
12. USDA Probe Receptacle PR3
13. Cargo Probe Receptacle PR4

3.1.4 Compressor Section

The compressor section includes the compressor, digital unloader valve (DUV), high pressure switch, discharge pressure transducer (DPT), evaporator pressure transducer (EPT) and the suction pressure transducer (SPT).

The supply temperature sensor and supply recorder sensor are located to the left of the compressor.

Figure 3.3 Compressor Section



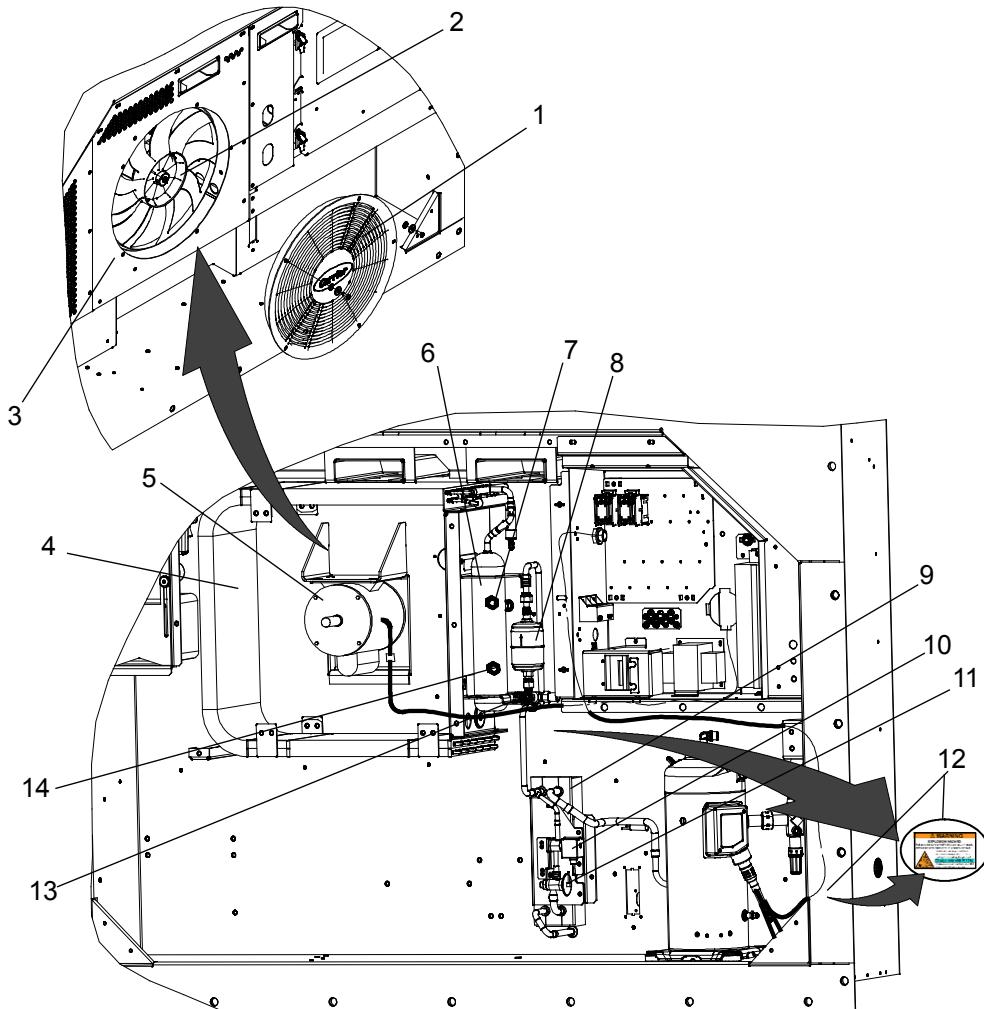
- | | |
|--|--|
| 1. Compressor | 9. Digital Unloader Valve (DUV) |
| 2. Compressor Discharge Temperature Sensor (CPDS) (Location) | 10. Suction Pressure Transducer (SPT) |
| 3. Discharge Connection | 11. Evaporator Pressure Transducer (EPT) |
| 4. Suction Connection (Location) | 12. High Pressure Switch (HPS) |
| 5. Compressor Terminal Box | 13. Discharge Service Valve |
| 6. Oil Drain (Location) | 14. Suction Service Valve |
| 7. Economizer Connection | 15. Supply Temperature/Supply Recorder Sensor Assembly (STS/SRS) |
| 8. Discharge Pressure Transducer (DPT) | 16. Warning Label |

3.1.5 Air-Cooled Condenser Section

The air-cooled condenser section consists of the condenser fan, condenser coil, receiver, liquid line service valve, filter drier, fusible plug, economizer, economizer expansion valve, economizer solenoid valve (ESV), and sight glass/moisture indicator.

The condenser fan pulls air from around the coil and discharges it horizontally through the condenser fan grille.

Figure 3.4 Air-Cooled Condenser Section



- 1. Grille and Venturi Assembly
- 2. Condenser Fan
- 3. Condenser Coil Cover
- 4. Condenser Coil
- 5. Condenser Fan Motor
- 6. Receiver
- 7. Sight Glass

- 8. Filter Drier
- 9. Economizer
- 10. Economizer Solenoid Valve (ESV)
- 11. Economizer Expansion Valve
- 12. Warning Label (location)
- 13. Service Access Valve
- 14. Liquid Level/Moisture Indicator

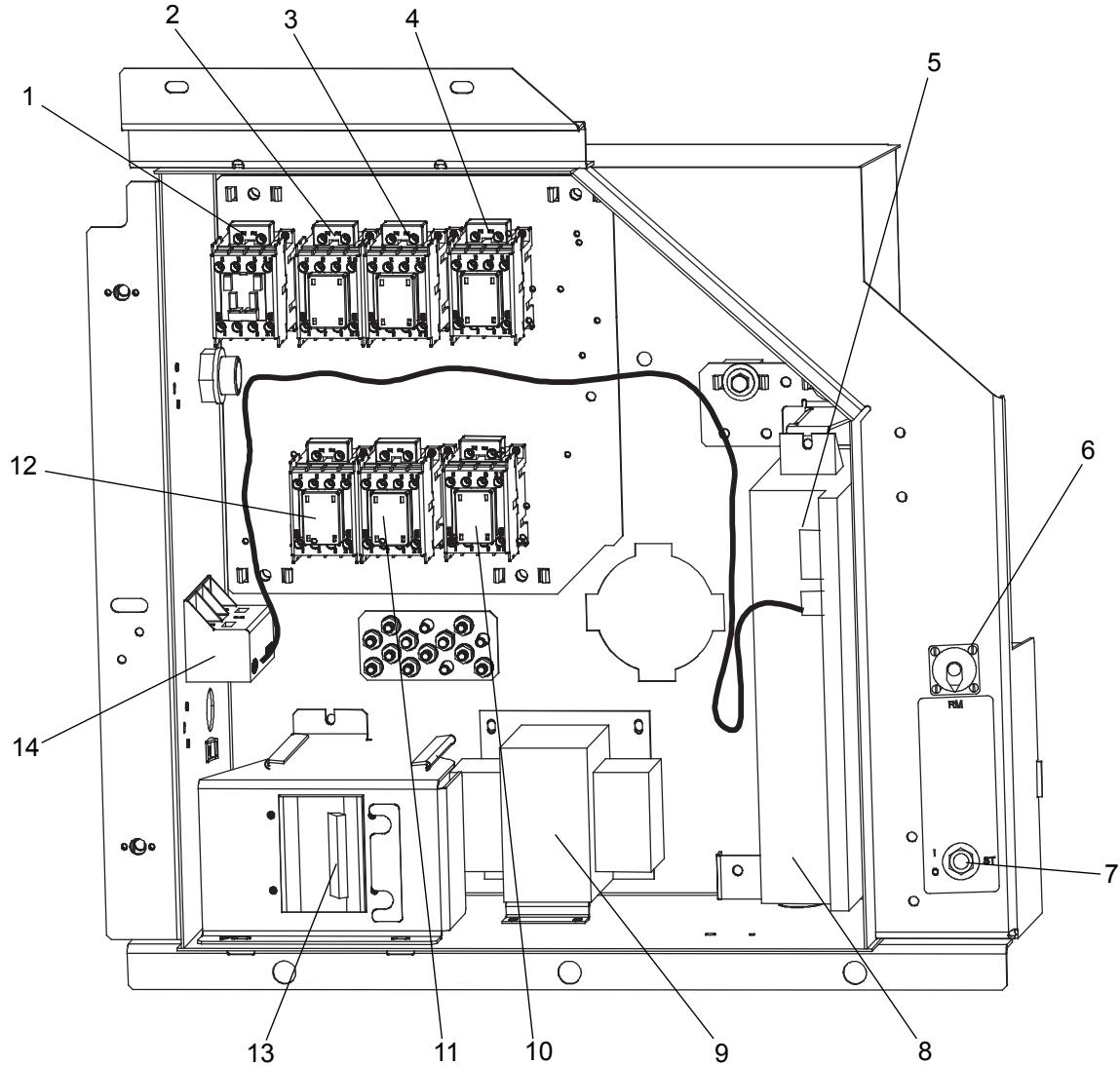
3.1.6 Control Box Section

The control box (Figure 3.5) includes: the manual operation switches, circuit breaker (CB-1), compressor, fan and heater contactors, control power transformer, fuses, key pad, display module, current sensor module, controller module and the communications interface module.

3.1.7 Communications Interface Module

The communications interface module is a slave module which allows communication between the refrigeration unit and a ship system master central monitoring station. The module will respond to communication and return information over the ships main power line. Refer to the master system technical manual for further information.

Figure 3.5 Control Box Section



1. Compressor Contactor - CH
2. Compressor Phase A Contactor - PA
3. Compressor Phase B Contactor - PB
4. Heater Contactor - HR
5. Controller/DataCORDER Module (Controller)
6. Remote Monitoring Receptacle
7. Start- Stop Switch, ST

8. Controller Battery Pack (Standard Location)
9. Control Transformer
10. High Speed Evaporator Fan Contactor - EF
11. Low Speed Evaporator Fan Contactor - ES
12. Condenser Fan Contactor - CF
13. Circuit Breaker - 460V
14. Current Sensor Module

3.2 REFRIGERATION SYSTEM DATA

a. Compressor/Motor Assembly	Model Number	ZMD26KVE- TFD- 272
	Weight (With Oil)	42.9 kg (95 lb)
	Approved Oil	Uniqema Emkarate RL- 32- 3MAF
	Oil Charge	1774 ml (60 ounces)
b. Electronic Expansion Valve Superheat (Evaporator)	Verify at - 18°C (0F) container box temperature	4.4 to 6.7°C (8 to 12°F)
c. Economizer Expansion Valve Superheat	Verify at - 18°C (0F) container box temperature	4.4 to 11.1°C (8 to 20°F)
d. Heater Termination Thermostat	Opens	54° (+/- 3) C = 130° (+/- 5) F
	Closes	38° (+/- 4) C = 100° (+/- 7) F
e. High Pressure Switch	Cut-Out	25 (+/- 1.0) kg/cm ² = 350 (+/- 10) psig
	Cut-In	18 (+/- 0.7) kg/cm ² = 250 (+/- 10) psig

 **WARNING**

EXPLOSION HAZARD: Failure to follow this WARNING can result in death, serious personal injury and / or property damage.

Never use air or gas mixtures containing oxygen (O₂) for leak testing or operating the product.
Charge Only With R- 134a: Refrigerant must conform to AHRI Standard 700 specification.

f. Refrigerant	R- 134a	Conforming to AHRI standard 700 specifications.
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 **CAUTION**

Charge water- cooled condenser or receiver according to nameplate specifications to ensure optimal unit performance.

g. Refrigerant Charge	Receiver	4.54 kg (10 lbs)
h. Fusible Plug	Melting point	99°C = (210°F)
	Torque	6.2 to 6.9 mkg (45 to 50 ft-lbs)
i. Rupture Disc	Bursts at	35 +/- 5% kg/cm ² = (500 +/- 5% psig)
	Torque	6.2 to 6.9 mkg (45 to 50 ft-lbs)
j. Unit Weight	Refer to unit model number plate.	
k. Water Pressure Switch	Cut-In	0.5 +/- 0.2 kg/cm ² (7 +/- 3 psig)
	Cut-Out	1.6 +/- 0.4 kg/cm ² (22 +/- 5 psig)

3.3 ELECTRICAL DATA

a. Circuit Breaker	CB-1 (25 amp)	Trips at 29 amps	
	CB-2 (50 amp)	Trips at 62.5 amps	
	CB-2 (70 amp)	Trips at 87.5 amps	
b. Compressor Motor	Full Load Amps (FLA)	13 amps @ 460 VAC	
c. Condenser Motor	Nominal Supply	380 VAC, Three Phase, 50 Hz	460 VAC, Three Phase, 60 Hz
	Full Load Amps	.71 amps	.72 amps
	Horsepower	0.21 hp	0.36 hp
	Rotations Per Minute	1450 rpm	1750 rpm
	Voltage and Frequency	360 - 460 VAC +/- 2.5 Hz	400 - 500 VAC +/- 2.5 Hz
	Bearing Lubrication	Factory lubricated, additional grease not required.	
	Rotation	Counter-clockwise when viewed from shaft end.	
d. Evaporator Heaters	Number of Heaters	6	
	Rating	750 watts +/- 10% each @ 230 VAC	
	Resistance (cold)	66.8 to 77.2 ohms @ 20°C (68°F)	
	Type	Sheath	
e. Evaporator Motor(s)		380 VAC/3 PH/50 Hz	460 VAC/3 PH/60 Hz
	Full Load Amps High Speed	1.07	.9
	Full Load Amps Low Speed	0.47	0.47
	Nominal Horsepower High Speed	0.36	0.63
	Nominal Horsepower Low Speed	0.05	0.8
	Rotations Per Minute High Speed	2850 rpm	3450 rpm
	Rotations Per Minute Low Speed	1425 rpm	1725 rpm
	Voltage and Frequency	360 - 460 VAC +/- 1.25 Hz	400 - 500 VAC +/- 1.5 Hz
	Bearing Lubrication	Factory lubricated, additional grease not required	
	Rotation	CW when viewed from shaft end	
f. Fuses	Control Circuit	7.5 amps (F3A,F3B)	
	Controller/DataCORDER	5 amps (F1 & F2)	
	Emergency Bypass	10 amps (FEB)	
g. Vent Positioning Sensor	Electrical Output	0.5 VDC to 4.5 VDC over 90 degree range	
	Supply Voltage	5 VDC +/- 10%	
	Supply Current	5 mA (typical)	

h. Solenoid Valve Coils (ESV) 24 VDC	Nominal Resistance @ 77°F (25°C)	7.7 ohms +/- 5%
	Maximum Current Draw	0.7 amps
i. DUV Coils 12 VDC	Nominal Resistance @ 77°F (20°C)	14.8 ohms +/- 5%
	Maximum Current Draw	929 mA
j. EEV Nominal Resistance	Coil Feed to Ground (Gray Wire)	47 ohms
	Coil Feed to Coil Feed	95 ohms
k. Humidity Sensor	Orange wire	Power
	Red wire	Output
	Brown wire	Ground
	Input voltage	5 VDC
	Output voltage	0 to 3.3 VDC
	Output voltage readings verses relative humidity (RH) percentage:	
	30%	0.99 V
	50%	1.65 V
	70%	2.31 V
	90%	2.97 V

3.4 SAFETY AND PROTECTIVE DEVICES

Unit components are protected from damage by safety and protective devices listed in **Table 3-1**. These devices monitor the unit operating conditions and open a set of electrical contacts when an unsafe condition occurs.

Open safety switch contacts on either or both of devices IP- CP or HPS will shut down the compressor.

Open safety switch contacts on device IP-CM will shut down the condenser fan motor.

The entire refrigeration unit will shut down if one of the following safety devices open: (a) circuit breaker(s); (b) fuse (F3A/F3B, 7.5A); or (c) evaporator fan motor internal protector(s) - (IP).

Table 3-1 Safety and Protective Devices

UNSAFE CONDITION	DEVICE	DEVICE SETTING
Excessive current draw	Circuit Breaker (CB-1, 25 amp) - Manual Reset	Trips at 29 amps (460 VAC)
	Circuit Breaker (CB-2, 50 amp) - Manual Reset	Trips at 62.5 amps (230 VAC)
	Circuit Breaker (CB-2, 70 amp) - Manual Reset	Trips at 87.5 amps (230 VAC)
Excessive current draw in the control circuit	Fuse (F3A & F3B)	7.5 amp rating
Excessive current draw by the controller	Fuse (F1 & F2)	5 amp rating
Excessive current draw by the Emergency Bypass module	Fuse (FEB)	10 amp rating
Excessive condenser fan motor winding temperature	Internal Protector (IP- CM) - Automatic Reset	N/A

Table 3–1 Safety and Protective Devices

UNSAFE CONDITION	DEVICE	DEVICE SETTING
Excessive compressor motor winding temperature	Internal Protector (IP- CP) - Automatic Reset	N/A
Excessive evaporator fan motor(s) winding temperature	Internal Protector(s) (IP- EM) - Automatic Reset	N/A
Abnormal pressures/temperatures in the high refrigerant side	Fusible Plug - Used on the Receiver Rupture Disc - Used on the Water- Cooled Condenser	99°C = (210°F) 35 kg/cm ² = (500 psig)
Abnormally high discharge pressure	High Pressure Switch (HPS)	Opens at 25 kg/cm ² (350 psig)

3.5 REFRIGERATION CIRCUIT

3.5.1 Standard Operation

Starting at the compressor, (see **Figure 3.6**, upper schematic) the suction gas is compressed to a higher pressure and temperature.

The refrigerant gas flows through the discharge line and continues into the air- cooled condenser. When operating with the air- cooled condenser active, air flowing across the coil fins and tubes cools the gas to saturation temperature. By removing latent heat, the gas condenses to a high pressure/high temperature liquid and flows to the receiver, which stores the additional charge necessary for low temperature operation.

The liquid refrigerant continues through the liquid line, the filter drier (which keeps refrigerant clean and dry) and the economizer (not active during standard operation) to the electronic expansion valve (EEV).

As the liquid refrigerant passes through the variable orifice of the EEV, the pressure drops to suction pressure. In this process some of the liquid vaporizes to a gas (flash gas), removing heat from the remaining liquid. The liquid exits as a low pressure, low temperature, saturated mix. Heat is then absorbed from the return air by the balance of the liquid, causing it to vaporize in the evaporator coil. The vapor then flows through the suction tube back to the compressor.

During the standard mode of operation, the normally closed digital unloader valve (DUV) controls the system refrigerant flow and capacity by loading and unloading the compressor in frequent discrete time intervals. If the system capacity has been decreased to the lowest allowable capacity with the DUV, the unit will enter a trim heat mode of operation, during which the controller will pulse the evaporator heaters in sequence with the compressor digital signal in order to absorb the excess capacity.

3.5.2 Economized Operation

In the economized mode, (see **Figure 3.7**) the frozen and pull down capacity of the unit is increased by subcooling the liquid refrigerant entering the electronic expansion valve. Overall efficiency is increased because the gas leaving the economizer enters the compressor at a higher pressure, therefore requiring less energy to compress it to the required condensing conditions.

Liquid refrigerant for use in the economizer circuit is taken from the main liquid line as it leaves the filter drier. The flow is activated when the controller energizes the economizer solenoid valve (ESV).

The liquid refrigerant flows through the ESV to the expansion valve internal passages, absorbing heat from the liquid refrigerant flowing to the electronic expansion valve. The resultant “medium” temperature/pressure gas enters the compressor at the economizer port fitting.

When the control air temperature falls to 2.0°C (3.6°F) above set point, the DUV unloads the compressor’s scroll and begins to reduce the capacity of the unit. Percentage of the unit capacity is accessed through code select 01 (Cd01). For example, if Cd01 displays 70, it indicates that the compressor is operating unloaded with the DUV engaged 30% of the time.

3.5.3 Electronic Expansion Valve

The microprocessor controls the superheat leaving the evaporator via the electronic expansion valve (EEV), based on inputs from the evaporator pressure transducer (EPT). The microprocessor transmits electronic pulses to the EEV stepper motor, which opens or closes the valve orifice to maintain the superheat set point.

Figure 3.6 Refrigeration Circuit Schematic - Standard Operation

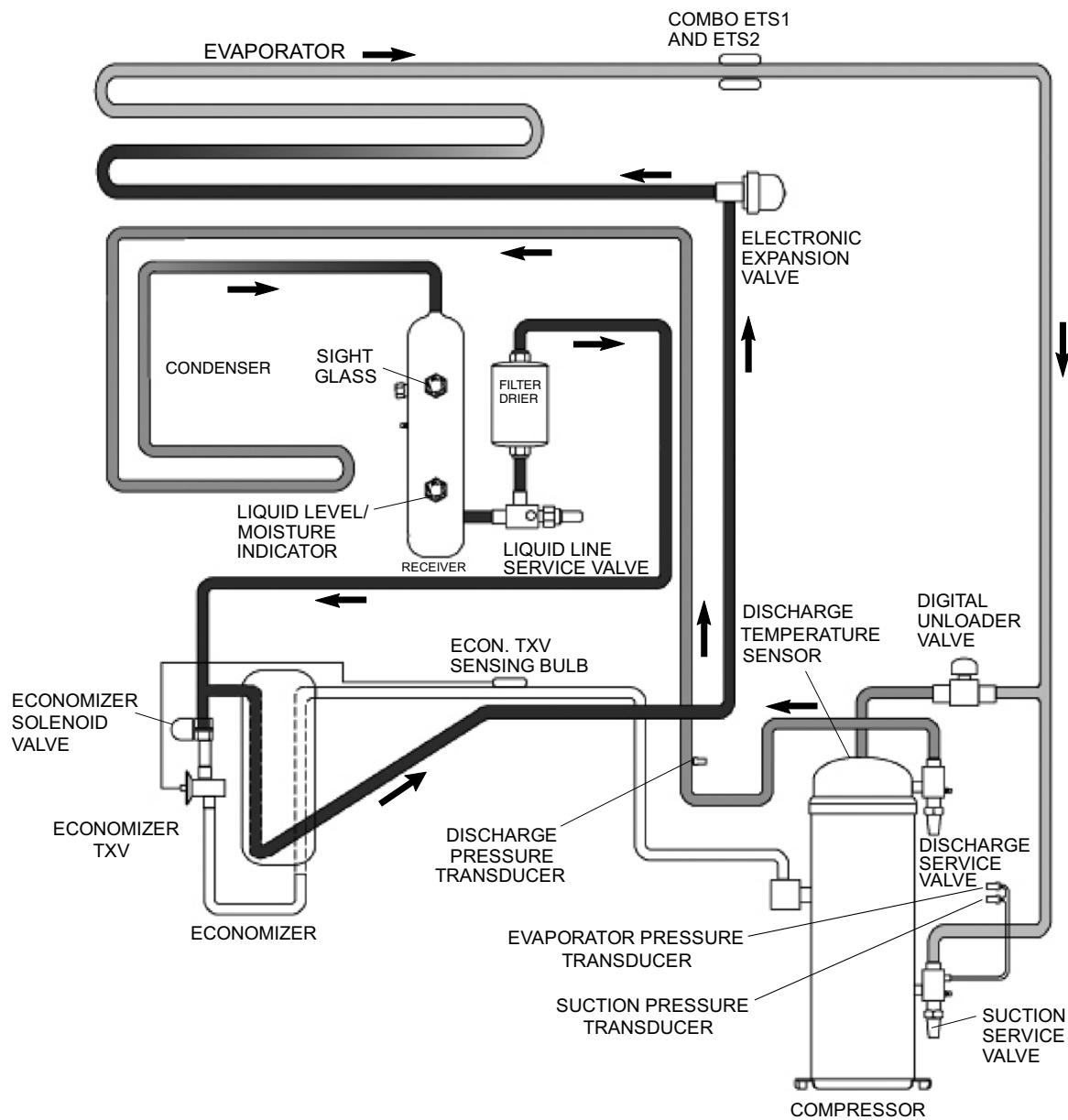


Figure 3.7 Refrigeration Circuit Schematic - Economized Operation

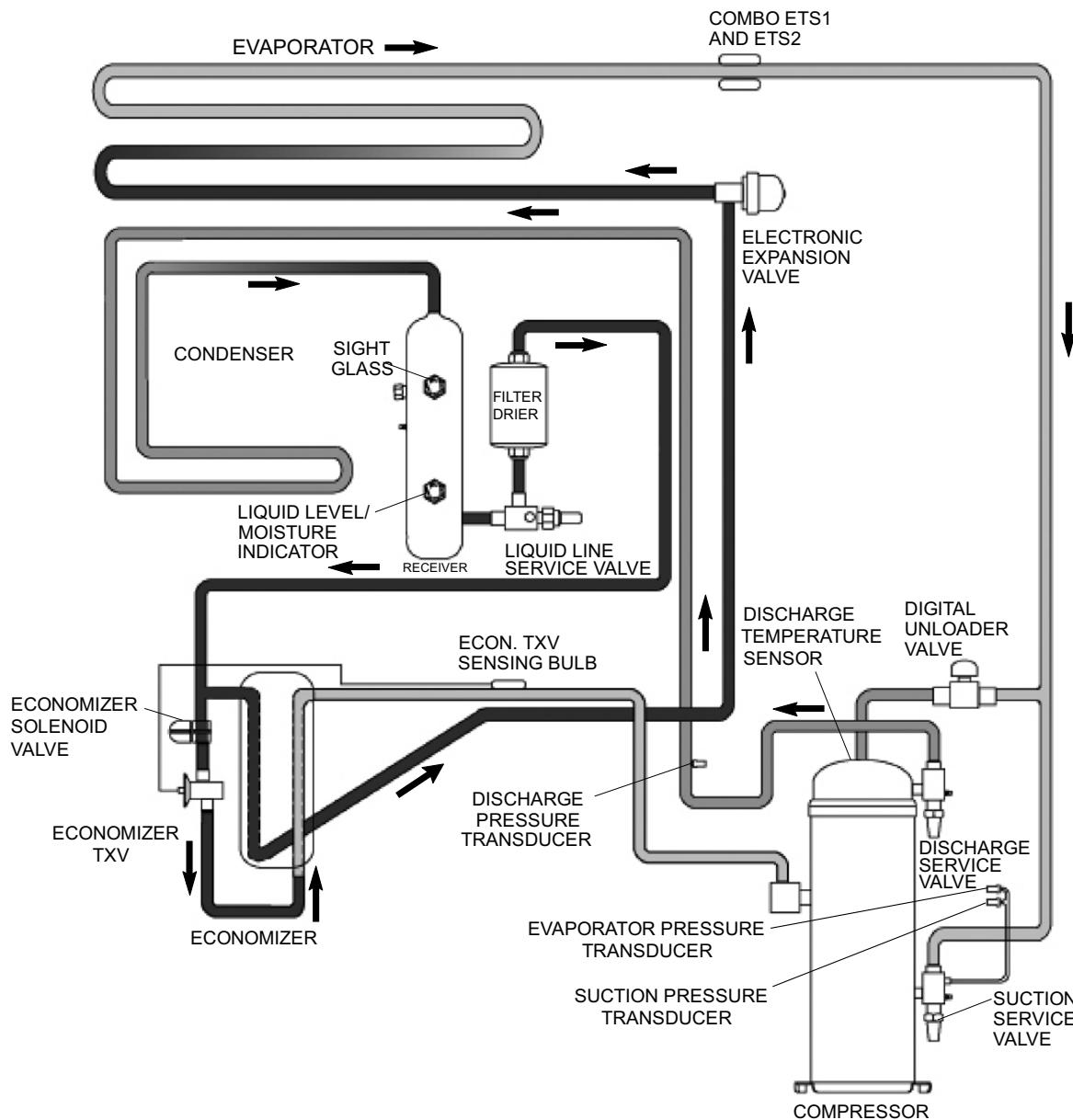
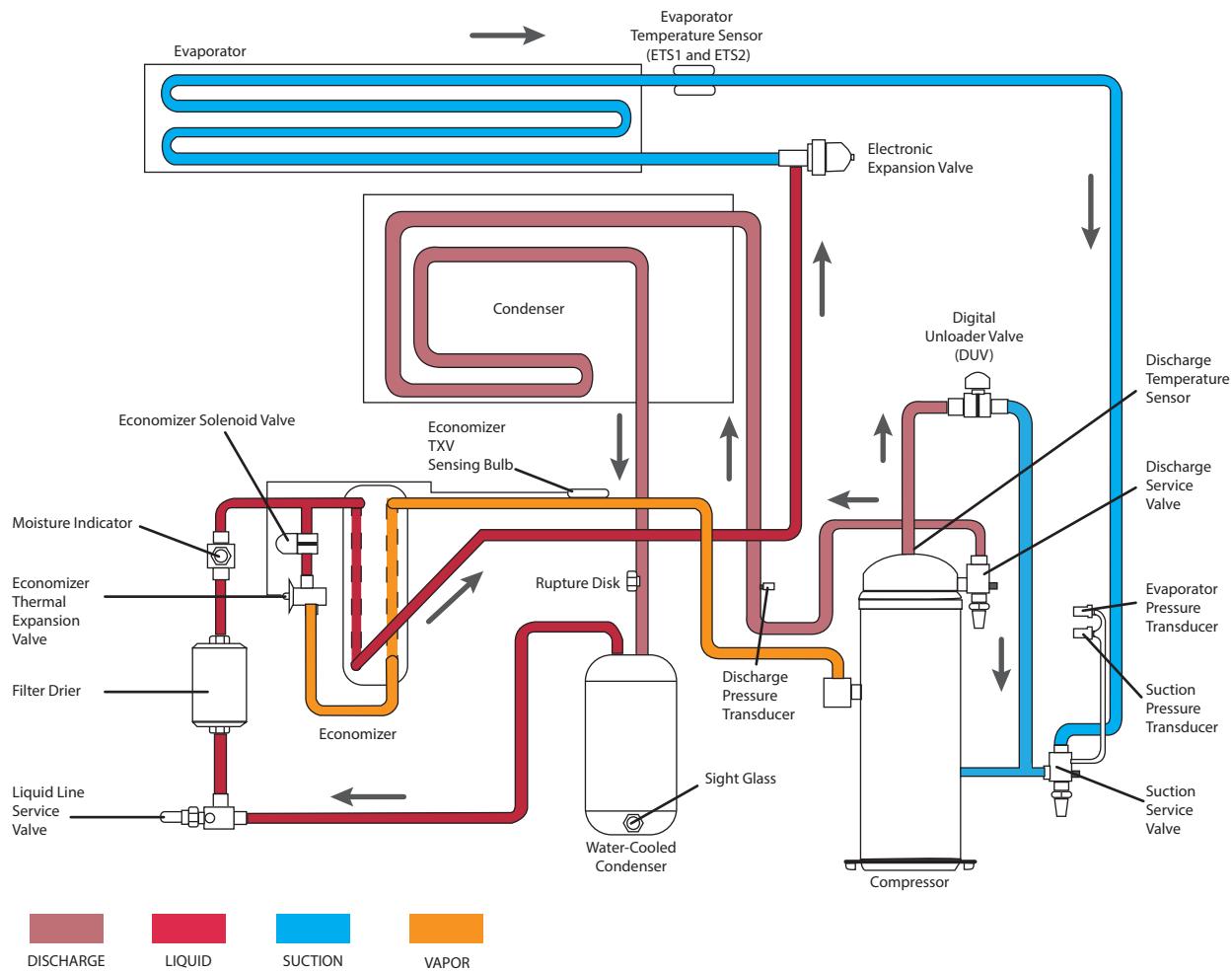


Figure 3.8 Refrigeration Circuit Schematic – Water Cooled Condenser Operation



SECTION 4

MICROPROCESSOR

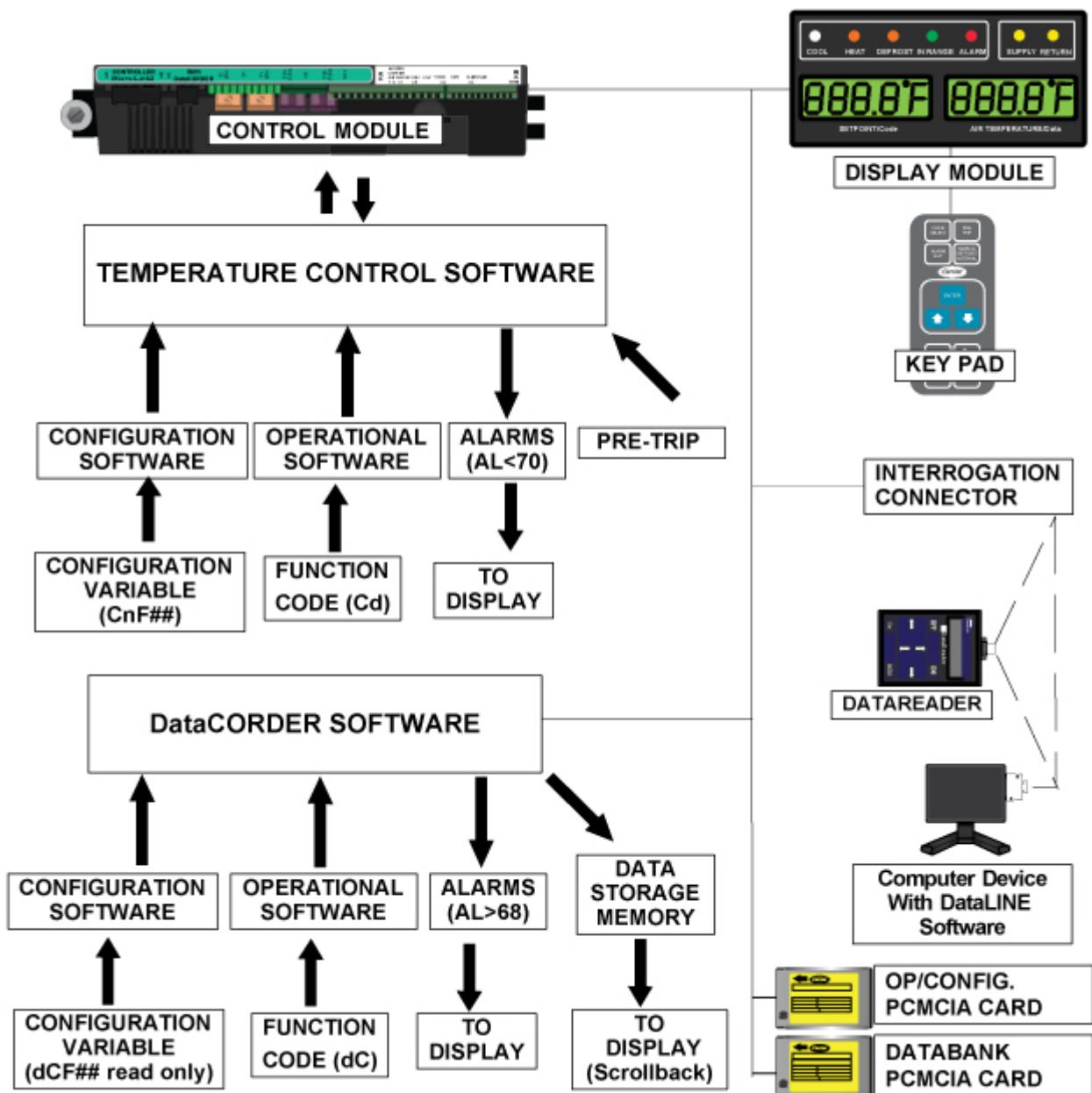
4.1 TEMPERATURE CONTROL MICROPROCESSOR SYSTEM

The temperature control Micro-Link 3 microprocessor system (see [Figure 4.1](#)) consists of a keypad, display module, the control module (controller) and interconnecting wiring. The controller houses the temperature control software and the DataCORDER software. The temperature control software functions to operate the unit components as required to provide the desired cargo temperature and humidity.

The DataCORDER software functions to record unit operating parameters and cargo temperature parameters for future retrieval. Coverage of the temperature control software begins with [Section 4.2](#). Coverage of the DataCORDER software is provided in [Section 4.8](#).

The keypad and display module serve to provide user access and readouts for both of the controller functions, temperature control and DataCORDER. The functions are accessed by keypad selections and viewed on the display module. The components are designed to permit ease of installation and removal.

Figure 4.1 Temperature Control System



4.1.1 Keypad

The keypad (Figure 4.2) is mounted on the control box door. The keypad consists of eleven push button switches that act as the user's interface with the controller. Descriptions of the switch functions are provided in Table 4-1.

Figure 4.2 Keypad

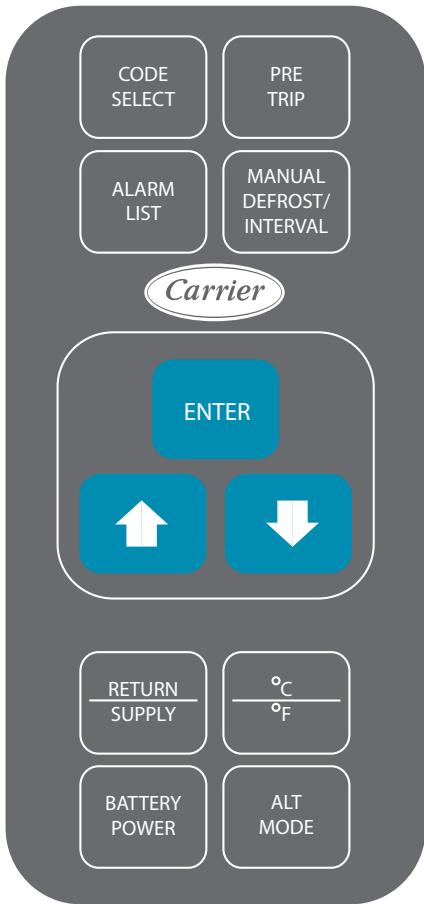


Table 4-1 Keypad Function

KEY	FUNCTION
CODE SELECT	Accesses function codes.
PRE TRIP	Displays Pre-trip selection menu. Discontinues Pre-trip in progress.
ALARM LIST	Displays alarm list and clears the alarm queue.
MANUAL DEFROST / INTERVAL	Displays selected defrost mode. Depress and hold the MANUAL DEFROST / INTERVAL key for five (5) seconds to initiate defrost using the same logic as if the optional manual defrost switch was toggled on.
ENTER	Confirms a selection or saves a selection to the controller.
Arrow Up	Change or scroll a selection up. Pre-trip advance or test interrupt.
Arrow Down	Change or scroll selection downward. Pre-trip repeat backward.
RETURN / SUPPLY	Display non-controlling probe temperature (momentary display).
Celsius / Fahrenheit	Display alternate English/Metric scale (momentary display). When set to F, pressure is displayed in psig and vacuum in "/hg." "P" appears after the value to indicate psig and "i" appears for inches of mercury. When set to C, pressure readings are in bars. "b" appears after the value to indicate bars.
BATTERY POWER	Initiate battery backup mode to allow set point & function code selection if AC power is not connected.
ALT MODE	This key is pressed to switch the functions from temperature software to the DataCORDER software. The remaining keys function the same as described above except the readings or changes are made to the DataCORDER programming.

4.1.2 Display Module

The display module (Figure 4.3) consists of two 5-digit displays and seven indicator lights. The indicator lights include:

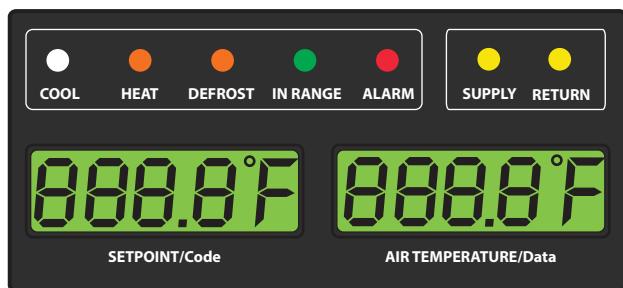
1. COOL - White or Blue LED: Energized when the refrigerant compressor is energized.
2. HEAT - Orange LED: Energized to indicate heater operation in heat mode, defrost mode, or dehumidification.
3. DEFROST - Orange LED: Energized when the unit is in defrost mode.
4. IN RANGE - Green LED: Energized when the controlled temperature probe is within the specified tolerance of set point.

NOTE

The controlling probe in perishable range is the SUPPLY air probe and the controlling probe in frozen range is the RETURN air probe.

5. SUPPLY - Yellow LED: Energized when the supply air probe is used for control. When this LED is illuminated, the temperature displayed in the AIR TEMPERATURE display is the reading at the supply air probe. This LED will flash if dehumidification or humidification is enabled.
6. RETURN - Yellow LED: Energized when the return air probe is used for control. When this LED is illuminated, the temperature displayed in the AIR TEMPERATURE display is the reading at the return air probe.
7. ALARM - Red LED: Energized when an active or an inactive shutdown alarm in the alarm queue.

Figure 4.3 Display Module



4.1.3 Controller

⚠ CAUTION

Do not remove wire harnesses from controller modules unless you are grounded to the unit frame with a static safe wrist strap.

⚠ CAUTION

Unplug all controller module wire harness connectors before performing arc welding on any part of the container.

⚠ CAUTION

Do not attempt to use anML2i PC card in an ML3 equipped unit. The PC cards are physically different and will result in damage to the controller.

NOTE

Do not attempt to service the controller modules. Breaking the seal will void the warranty.

The Micro-Link 3 controller is shown in **Figure 4.4**. It is fitted with test points, harness connectors and a software card programming port.

4.2 CONTROLLER SOFTWARE

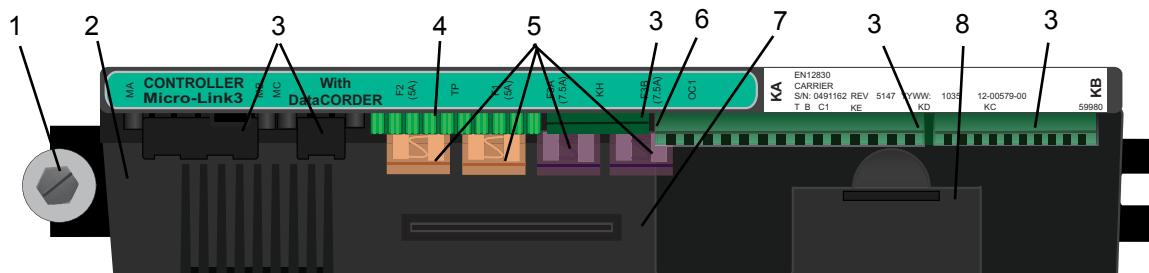
The controller software is a custom designed program that is subdivided into configuration software and operational software. The controller software performs the following functions:

- Control supply or return air temperature to required limits, provide modulated refrigeration operation, economized operation, unloaded operation, electric heat control, and defrost. Defrost is performed to clear buildup of frost and ice to ensure proper air flow across the evaporator coil.
- Provide default independent readouts of set point and supply or return air temperatures.
- Provide ability to read and (if applicable) modify the configuration software variables, operating software Function Codes and Alarm Code indications.
- Provide a Pre-trip step-by-step checkout of refrigeration unit performance including: proper component operation, electronic and refrigeration control operation, heater operation, probe calibration, pressure limiting and current limiting settings.
- Provide battery-powered ability to access or change selected codes and set point without AC power connected.
- Provide the ability to reprogram the software through the use of a memory card.

4.2.1 Configuration Software (Cnf Variables)

Configuration software is a variable listing of the components available for use by the operational software. This software is factory installed in accordance with the equipment fitted and options listed on the original purchase order. Changes to the configuration software are required only when a new controller has been installed or a physical change has been made to the unit such as the addition or removal of an option. A configuration variable list is provided in **Table 4-4**. Change to the factory-installed configuration software is achieved via a configuration card or by communications.

Figure 4.4 Control Module



- Mounting Screw
- Micro-Link 3 Control/DataCORDER Module
- Connectors
- Test Points

- Fuses
- Control Circuit Power Connection
- Software Programming Port
- Battery Pack (Standard Location)

4.2.2 Operational Software (Cd Function Codes)

The operational software is the actual operation programming of the controller which activates or deactivates components in accordance with current unit operating conditions and selected modes of operation.

The programming is divided into function codes. Some of the codes are read only, while the remaining codes may be user configured. The value of the user configurable codes can be assigned in accordance with user desired mode of operation. A list of the function codes is provided in [Table 4–5](#).

To access the function codes:

- a. Press CODE SELECT, then press an arrow key until the left window displays the desired function code.
- b. The right window will display the selected function code value for five seconds before returning to normal display mode.
- c. If additional time is required, pressing the ENTER key will extend the display time to 30 seconds.

4.3 MODES OF OPERATION

General operation sequences for cooling, heating and defrost are provided in the following sub-paragraphs. Schematic representation of controller operation is provided in [Figure 4.5](#) & [Figure 4.8](#).

Operational software responds to various inputs. These inputs come from the temperature sensors and pressure transducers, the temperature set point, the settings of the configuration variables and the function code assignments. The action taken by the operational software changes as the input values change. Overall interaction of the inputs is described as a “mode” of operation. The modes of operation include perishable (chill) mode and frozen mode. Descriptions of the controller interaction and modes of operation are provided in the following sub paragraphs.

4.3.1 Start up - Compressor Phase Sequence

At start up, the controller logic checks for proper phase sequencing and compressor rotation. If incorrect sequencing is causing the compressor and three-phase evaporator fan motors to rotate in the wrong direction, the controller will energize or de-energize relay TCP as required (see [Figure 8.2](#)). Relay TCP will switch its contacts, energizing or de-energizing relays PA and PB. Relay PA is wired to energize the circuits on L1, L2 and L3. Relay PB is wired to energize the circuits on L3, L2, and L1, thus providing reverse rotation.

4.3.2 Start up - Compressor Bump Start

At start up, the controller logic will initiate a compressor bump start procedure to clear liquid refrigerant from the compressor. If suction and discharge pressures have equalized, the compressor will perform three compressor bump starts. A compressor bump start may also occur after a defrost cycle has been completed.

During Bump Start, the EEV will close. Relays TS, TQ, TN, TE, and TV will be de-energized (opened). The result of this action will close the ESV and shut all fans off. The compressor will start for 1 second, then pause for five seconds. This sequence will be repeated two more times. After the final bump start the unit will pre-position the EEV to the correct starting position, pause and start up.

4.3.3 Perishable Mode Temperature Control

In Perishable Mode, the controller maintains the supply air temperature at set point, the SUPPLY indicator light is illuminated and the default reading on the display window is the supply temperature sensor reading.

When the supply air temperature enters the in-range temperature tolerance (Cd30), the green IN-RANGE light will energize.

When CnF26 (Heat Lockout Temperature) is set to -10°C, perishable mode is active with set points above -10°C (+14°F). When CnF26 is set to -5°C, perishable mode is active with set points above -5°C (+23°F).

4.3.4 Perishable Pulldown

When the system is in Perishable Pulldown Mode, the highest priority is given to bringing the container down to set point. When cooling from a temperature that is more than 2.5°C (4.5°F) above set point, the system will be in perishable pulldown mode in economized operation.

However, pressure and current limit functions may restrict the valve if either exceeds the preset value.

4.3.5 Perishable Steady State

Perishable Steady State is used to maintain the control temperature near a setpoint that is above the heat lockout temperature.

Once set point is reached, the unit will transition to perishable steady state mode. This results in unloaded operation by cycling the DUV to limit capacity and maintain steady temperature control.

The unit is capable of maintaining supply air temperature to within +/-0.2°C (+/-0.36°F) of set point. Supply air temperature is controlled by positioning of the electronic expansion valve (EEV), cycling of the digital unloader valve (DUV), cycling of the compressor, and cycling of the heaters.

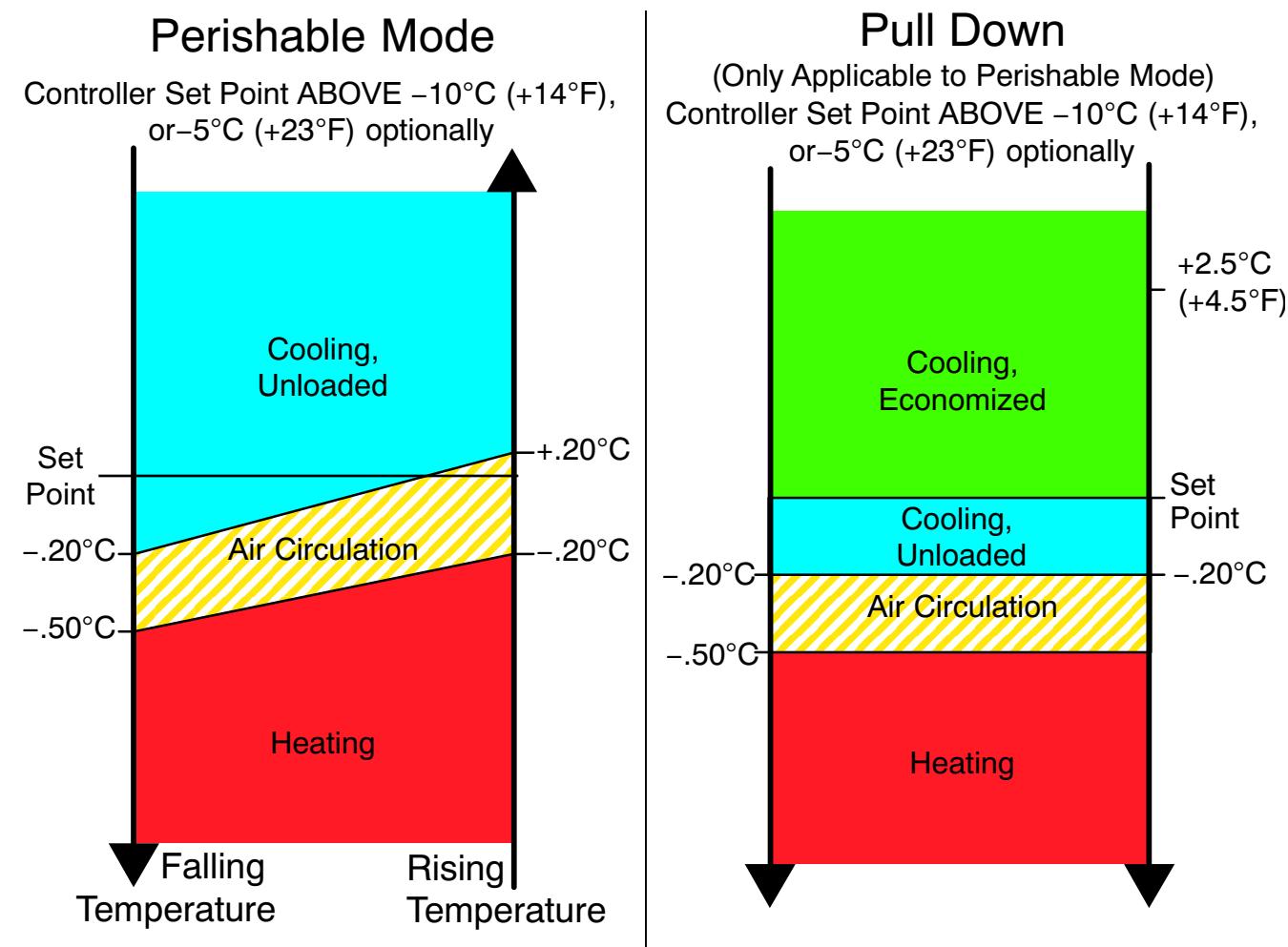
4.3.6 Perishable Idle, Air Circulation

Perishable Idle Mode is used when it is unnecessary to run the compressor to maintain control temperature. If the controller has determined that cooling is not required or the controller logic determines suction pressure is at the low pressure limit, the unit will transition to Perishable Idle Mode. During Perishable Idle Mode, the compressor is turned off, but the evaporator fans continue to run to circulate air throughout the container. If temperature rises +0.2°C above set point, the unit will transition back to perishable steady state.

4.3.7 Perishable Heating

When it is necessary to raise the control temperature, the system will enter Perishable Heating Mode. If the temperature drops to 0.5°C (0.9°F) below set point, the unit will transition to Perishable Heating Mode, and the heaters will be energized. The unit will transition back to Perishable Idle Mode when the temperature rises to 0.2°C (0.4°F) below the set point, and the heaters will de-energize.

Figure 4.5 Controller Operation - Perishable Mode



4.3.8 Perishable Dehumidification

Dehumidification is provided to reduce the humidity levels inside the container, the dehumidification set point range is from 50% to 95%. Dehumidification is activated when a humidity value is set at Cd33. The yellow SUPPLY LED will flash ON and OFF every second to indicate that dehumidification is active. Once dehumidification is active and the following conditions are satisfied, the controller will activate the heat relay to begin dehumidification.

1. The humidity sensor reading is above the humidity set point (Cd33).

2. The unit is in perishable steady state and supply air temperature is less than 0.25°C (0.45°F) above set point.
3. The heater debounce timer (three minutes) has timed out.
4. Heater termination thermostat (HTT) is closed.

If the above conditions are true for at least one hour the evaporator fans will switch from high speed to low speed. Evaporator fan speed will then switch every hour, as long as the 4 conditions are met (see Bulb Mode, **Section 4.3.9** for different evaporator fan speed options).

If any condition except item (1) becomes false OR if the

relative humidity sensed is 2% below the dehumidification set point, the high speed evaporator fans will be energized.

During dehumidification power is applied to the defrost heaters. This added heat load causes the controller to open the EEV to match the increased heat load while still holding the supply air temperature very close to the set point.

Opening the EEV reduces the temperature of the evaporator coil surface, which increases the rate at which water is condensed and removes water from the passing air. Removing water from the air reduces the relative humidity. When the relative humidity sensed is 2% below set point, the controller de-energizes the heat relay. The controller will continue to cycle heating to maintain relative humidity below the selected set point. If dehumidification is terminated by a condition other than the humidity sensor, e.g., an out-of-range or compressor shutdown condition, the heat relay is de-energized immediately.

Two timers are activated during dehumidification to prevent rapid cycling and consequent contactor wear:

1. Heater debounce timer (three minutes) - The heater debounce timer is started whenever the heater contactor status is changed. The heat contactor remains energized (or de-energized) for at least three minutes even if the set point criteria are satisfied.
2. Out-of-range timer (five minutes) - The out-of-range timer is started to maintain heater operation during a temporary out-of-range condition. If supply air temperature remains outside of the user selected in-range setting for more than five minutes, the heaters will be de-energized to allow the system to recover. The out-of-range timer starts as soon as temperature exceeds in-range tolerance value set by Cd30.

4.3.9 Perishable Dehumidification - Bulb Mode

Bulb mode is an extension of dehumidification which allows changes to the evaporator fan speed and/or defrost termination set points.

Bulb mode is active when Cd35 is set to "Bulb." Once bulb mode is activated, the user may then change dehumidification evaporator fan operation from the default (speed alternates from low to high each hour) to constant low or constant high speed. This is done by toggling Cd36 from its default of "alt" to "Lo" or "Hi" as desired. If low speed evaporator fan operation is selected, this gives the user the additional capability of selecting dehumidification set points from 50 to 95%.

In addition, if bulb mode is active, Cd37 may be set to override the previous defrost termination thermostat (DTT) settings. The temperature at which the DTT will be considered "open" may be changed [in 0.1°C(0.2°F) increments] to any value between 25.6°C (78°F) and 4°C (39.2°F). The temperature at which the DTT is considered closed for interval timer start or demand

defrost is 10°C (50°F) for "open" values from 25.6°C (78°F) down to a 10°C(50°F) setting. For "open" values lower than 10°C, the "closed" values will decrease to the same value as the "open" setting. Bulb mode is terminated when:

1. Bulb mode code Cd35 is set to "Nor."
2. Dehumidification code Cd33 is set to "Off."
3. The user changes the set point to one that is in the frozen range.

When bulb mode is disabled by any of the above conditions, evaporator fan operation for dehumidification reverts to "alt" and the DTS termination setting resets to the value determined by CnF41.

4.3.10 Perishable Economy

Economy fan mode is an extension of the Perishable Mode, and is provided for power saving purposes. Economy fan mode is activated when Cd34 (also used for Frozen Economy Mode) is set to "ON." Economy fan mode is used in the transportation of temperature-tolerant cargo or non-respiration items which do not require high airflow for removing respiration heat.

There is no active display that indicates that economy fan mode has been initiated. To check for economy fan mode, perform a manual display of Cd34.

In order to initiate economy fan mode, a perishable set point must be selected prior to activation. When economy fan mode is active, the evaporator fans will be controlled as follows:

At the start of each cooling or heating cycle, the evaporator fans will run in high speed for three minutes. They will then be switched to low speed any time the supply air temperature is within +/- 0.2°C (0.36°F) of the set point and the return air temperature is less than or equal to the supply air temperature +3°C (5.4°F). The fans will continue to run in low speed for one hour. At the end of the hour, the evaporator fans will switch back to high speed and the cycle will be repeated. If bulb mode is active, economy fan mode will be overridden.

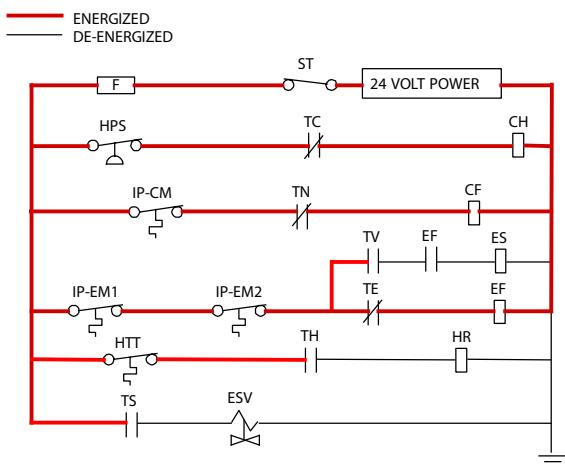
4.3.11 Perishable Mode Cooling - Sequence of Operation

NOTE

In Standard Perishable Mode, the evaporator motors run in high speed. In Economy Fan Mode, the fan speed is varied.

- a. When supply air temperature is above set point and decreasing, the unit will cool with the condenser fan motor (CF), compressor motor (CH), and evaporator fan motors (EF) energized, and the white COOL light illuminated. (See [Figure 4.6](#)). Also, if current or pressure limiting is not active, the controller will close contacts TS to open the economizer solenoid valve (ESV) and place the unit in economized operation.

Figure 4.6 Perishable Mode Cooling



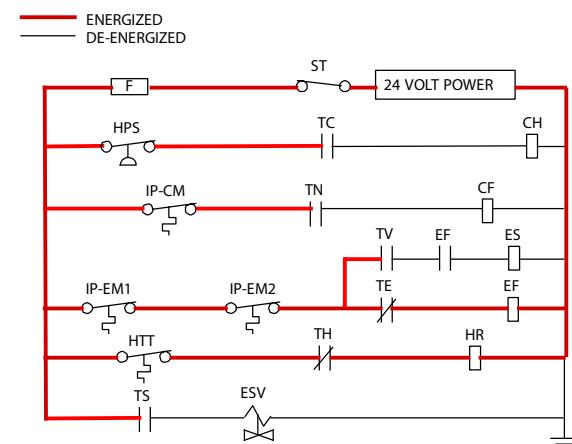
- b. When supply air temperature decreases to a predetermined tolerance above set point (Cd30), the green IN RANGE light is illuminated.
- c. As air temperature continues to fall, unloaded cooling starts (DUV pulses opens) as the supply air temperature approaches set point. (See [Figure 4.5](#)).
- d. When unloaded cooling starts, EEV control will transition from a full cool superheat set point to a lower modulated cool superheat set point. Once unloading starts, the EEV controls evaporator superheat based on the system duty cycle where instantaneous superheat will vary.
- e. When the supply air temperature has fallen to within 1.9°C (3.4°F) of set point temperature and the average capacity of the system has fallen below 70%, the unit will open contacts TS to close the ESV and take the unit out of economized operation.
- f. The controller continuously monitors supply air temperature. Once the supply air temperature falls below set point, the controller periodically records supply air temperature, set point and time. A calculation is then performed to determine temperature drift from set point over time. If the calculation determines that cooling is no longer required, contacts TC and TN are opened to de-energize the compressor motor and the condenser fan motor. In addition the controller will close the EEV.
- g. The evaporator fan motors continue to run to circulate air throughout the container. The green IN RANGE light remains illuminated as long as the supply air temperature is within tolerance of the set point.
- h. If the supply air temperature increases to 1.0°C (1.8°F) above set point and three minutes have elapsed, contacts TC and TN close to restart the compressor and condenser fan motors in standard mode (non-economized) operation. The white COOL light is also illuminated.

- i. If the average system capacity has risen to 100% during unloaded cooling and three minutes off time has elapsed, relay TS will energize to open the ESV, placing the unit in economized mode.
- j. If the supply air increases more than 2.5°C (4.5°F) above set point temperature, the microprocessor will transition the evaporator superheat control from modulation back to full cool control.

4.3.12 Perishable Mode Heating - Sequence of Operation

- a. If the supply air temperature decreases 0.5°C (0.9°F) below set point, the system enters the heating mode. (See [Figure 4.5](#)). The controller closes contacts TH (see [Figure 4.7](#)) to allow power flow through the heat termination thermostat (HTT) to energize the heaters (HR). The orange HEAT light is also illuminated. The evaporator fans continue to run to circulate air throughout the container.
- b. When the supply air temperature rises to 0.2°C (0.4°F) below set point, contact TH opens to de-energize the heaters. The orange HEAT light is also de-energized. The evaporator fans continue to run to circulate air throughout the container.
- c. The safety heater termination thermostat (HTT) is attached to an evaporator coil circuit and will open the heating circuit if overheating occurs.

Figure 4.7 Perishable Mode Heating



NOTE

The EEV and DUV are independently operated by the microprocessor. For full diagrams and legend, see [Section 8](#).

4.3.13 Perishable Mode - Trim Heat

If the system capacity has been decreased to the lowest allowable capacity and conditions exist that warrant maximum temperature stability the controller will pulse the HR relay to energize the evaporator heaters in sequence with the compressor digital signal.

4.3.14 Frozen Mode - Temperature Control

In Frozen Mode, the controller maintains the return air temperature at set point, the yellow RETURN indicator light is illuminated, and the default reading on the display window is the return temperature sensor (RTS) reading. When the return air temperature enters the in-range temperature tolerance (Cd30), the green IN-RANGE light will energize.

When CnF26 (Heat Lockout Temperature) is set to -10°C , frozen mode is active with set points below -10°C ($+14^{\circ}\text{F}$). When CnF26 is set to -5°C , frozen mode is active with set points below -5°C ($+23^{\circ}\text{F}$).

When the system is in Frozen Mode, the highest priority is given to bringing the container down to set point, the system will remain in economized operation.

4.3.15 Frozen Steady State

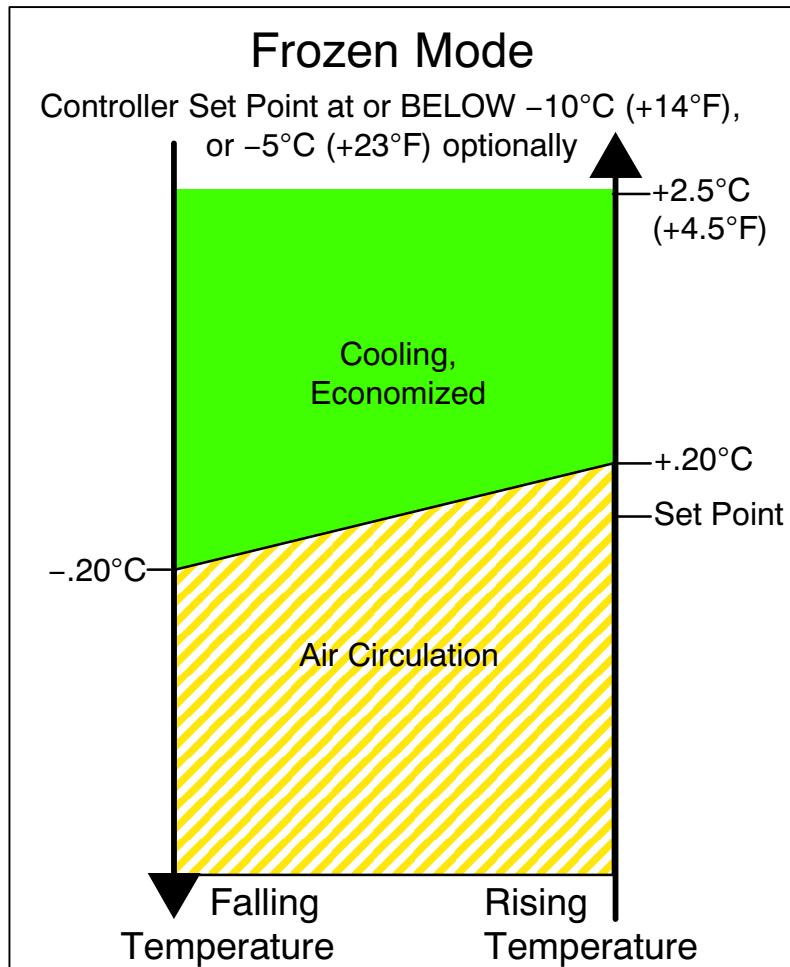
Frozen cargos are not sensitive to minor temperature changes, and the frozen temperature control system takes advantage of this to greatly improve the energy efficiency of the unit. Frozen range temperature control is accomplished by cycling the compressor on and off as the load demand requires.

Once the frozen set point is reached, the unit will transition to frozen steady state (economized operation).

4.3.16 Frozen Idle Mode

When temperature drops to set point minus 0.2°C (0.4°F) and the compressor has run for at least five minutes, the unit will transition to the frozen idle mode. The compressor is turned off and the evaporator fans continue to run to circulate air throughout the container. If temperature rises above set point $+0.2^{\circ}\text{C}$, (0.4°F) the unit will transition back to the frozen steady state mode.

Figure 4.8 Controller Operation - Frozen Mode



4.3.17 Frozen "Heat" Mode

If the temperature drops 10°C (18°F) below set point, the unit will transition to the frozen "heating" mode. The evaporator fans are brought to high speed, and the heat from the fans is circulated through the container. The unit will transition back to frozen steady state when the temperature rises back to the transition point.

4.3.18 Frozen Economy Mode

In order to activate Frozen Economy Mode, a frozen set point temperature must be selected, and Cd34 (Economy Mode) set to "ON." When economy mode is active, the system will perform normal frozen mode operations except that the entire refrigeration system,

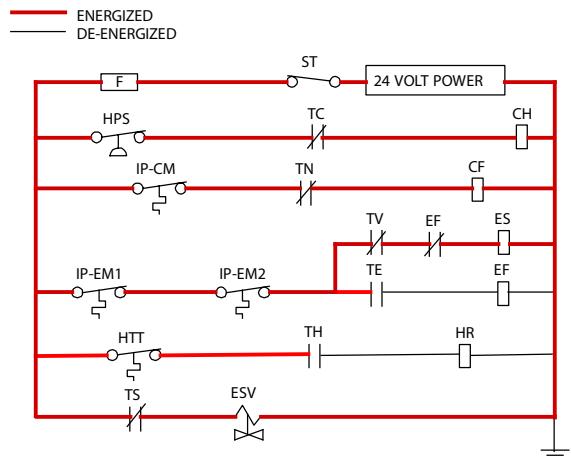
excluding the controller, will be turned off when the control temperature is less than or equal to the set point -2°C (4°F).

After an off-cycle period of 60 minutes, the unit will turn on high speed evaporator fans for three minutes, and then check the control temperature. If the control temperature is greater than or equal to the frozen set point +0.2°C (0.4°F), the unit will restart the refrigeration system and continue to cool until the off-cycle temperature criteria are met. If the control temperature is less than the frozen set point +0.2°C (0.4°F) the unit will turn off the evaporator fans and restart another 60 minute off-cycle.

4.3.19 Frozen Mode Cooling - Sequence of Operation

- When the return air temperature is above set point and decreasing, the unit will transition to economized cooling with the condenser fan motor (CF), compressor motor (CH), economizer solenoid valve (ESV), low speed evaporator fan motors (ES) energized and the white COOL light illuminated. (See [Figure 4.9](#)).
- When the return air temperature decreases to a predetermined tolerance above set point, the green INRANGE light is illuminated.
- When the return air temperature decreases to 0.2°C (0.4°F) below set point, contacts TC, TS and TN are opened to de-energize the compressor, economizer solenoid valve and condenser fan motor. The white COOL light is also de-energized. The EEV will close.
- The evaporator fan motors continue to run in low speed to circulate air throughout the container. The green IN-RANGE light remains illuminated as long as the return air is within tolerance of set point.
- If return air temperature drops to 10°C (18°F) or more below set point, the evaporator fans increase to high speed.
- When the return air temperature increases to 0.2°C (0.4°F) above set point and three minutes have elapsed, the EEV opens and contacts TC, TS and TN close to restart the compressor, open the ESV and restart the condenser fan motor. The white COOL is illuminated.

Figure 4.9 Frozen Mode



NOTE

The EEV and DUV are independently operated by the microprocessor. Complete schematics and legends are located in [Section 8](#).

4.3.20 Defrost

Defrost is initiated to remove ice buildup from the evaporator coil which can obstruct air flow and reduce the cooling capacity of the unit. The defrost cycle may consist of up to three distinct operations depending upon the reason for the defrost or model number configuration. The first is de-icing of the coil, the second is defrost due to a probe check cycle and the third is a snap freeze process based on the unit model configuration.

Defrosting the coil consists of removing power to the cooling components (compressor, evaporator fans, and condenser fan), closing the EEV, and turning on the heaters, which are located below the evaporator coil. During normal operation, de-icing will continue until temperatures indicate that the ice on the coil has been removed, proper air flow has been restored, and the unit is ready to control temperature efficiently.

If defrost was initiated by the probe check logic, then the Probe Check is carried out after the completion of the defrost cycle. A Probe Check is initiated only when there is an inaccuracy between the controller temperature sensors. For more information on Probe Check refer to [Section 5.7](#).

Snap Freeze allows the system to cool for a period of time after de-icing, with the evaporator fans turned off and is only carried out if configured by model number. Snap-Freeze allows for the removal of latent de-icing heat from the evaporator coils, and freezes any remaining moisture that might otherwise be blown into the container

For more information on Probe Check refer to **Section 5.9**

4.3.21 Defrost Operation

Initiation of defrost is dependent on the state of the Defrost Temperature Sensor (DTS). When then (DTS) senses a temperature less than 10°C (50°F) the defrost options become active and the timer is engaged for the initiation of the defrost cycle. The defrost time accumulates when the compressor is running. In the perishable mode this is the same as real time as the compressor in general runs continuously. In frozen mode the actual time necessary to count down to the next defrost will exceed the defrost interval depending on the compressor duty-cycle.

When the defrost mode is in the active state, defrost can be initiated when any one of the following additional conditions become true:

1. **Manually:** While in the Defrost screen, when the Manual Defrost soft key is selected, if conditions will allow for a defrost, a manual defrost is initiated. The Defrost Indicator light is lit, and the user is brought back to the Main / Default screen.

While in the Defrost screen, when Manual Defrost soft key is selected, and conditions will NOT allow a defrost, a pop up message screen appears.

2. **Timer:** The Defrost Interval Timer reaches the user selectable Interval. The user-selected intervals are 3, 6, 9, 12, 24 Hours, Off, AUTO, Pulse, or AUTO2; factory default is 3 hours. Refer to Defrost Interval setting on the Trip Settings screen.
 - a. Automatic defrost starts with an initial defrost at three hours and then adjusts the interval to the next defrost based on the accumulation of ice on the evaporator coil. Following a start-up or after termination of defrost, the time will not begin counting down until the DTS reading falls below 10°C (50°F). If the reading of DTS rises above termination setting any time during the timer count down, the interval is reset and the countdown starts over. The Auto defrost time is reset to three hours start time after every PTI initiation or trip start interval.

2. **Fan Pulsing Logic:** Fan pulsing logic is used to help prevent ice formation in the drain gutter and drain cup and ice buildup in supply air channel by using the evaporator fans to blow the warm air onto these areas during unit defrost. When cooling at lower set points, evaporator fan pulsing can be used during Defrost/De-ice when the "Pulse" option is selected for the Defrost Interval setting on the

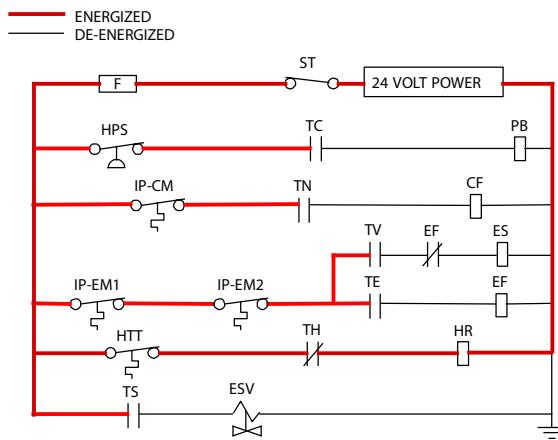
Trip Settings screen. When enabled, evaporator fan pulsing will occur based on the unit temperature set point and the Evap Fan Pulsing Temp setting on the Trip Settings screen. QUEST II also pulses the evaporator fans during Defrost/De-ice within a narrow perishable set point range. The logic for each evaporator fan pulsing feature is described below.

- c. After a new Defrost Interval is selected, the previously selected Interval is used until the next defrost termination, the next time the DTS contacts are OPEN, or the next time power to the control is interrupted. If the previous value or the new value is "OFF", the newly selected value will be used immediately.
3. **Probe Check:** If defrost is initiated due to Probe Check immediately following the defrost cycle the evaporation fans are started and run for eight minutes to stabilize the temperature throughout the container. A probe check comparison is carried out at the end of the eight minute period if any sensor is found out of calibration. At this time its alarm set is no longer used for control/reorder purposes.
4. **Probe Check Logic:** The logic determines that a Probe Check is necessary based on temperature values currently reported by the supply and return probes
5. **Delta T Logic:** If the difference between return and supply air temperature (Delta T) becomes too great indicating possible reduced airflow over the evaporator coil caused by ice buildup requiring a defrost.
 - a. In Perishable Pull Down - Delta T increases to greater than 12°C, and 90 minutes of compressor run time have been recorded.
 - b. In Perishable Steady State – A baseline Delta T is recorded following the first defrost cycle after steady state conditions are reached, (the unit is cooling, and the evaporator fans and heaters must remain in a stable state for a period of five minutes). Defrost will be initiated if Delta T increases to greater than 4°C above the baseline, and 90 minutes of compressor run time have been recorded.
 - c. In Frozen Mode - Defrost will be initiated if Delta T increases to greater than 16°C and 90 minutes of compressor run time have been recorded.

When defrost is initiated, the controller closes the EEV, opens contacts TC, TN and TE (or TV) to de-energize the compressor, condenser fan and evaporator fans.

The controller then closes contacts TH to supply power to the heaters. The orange DEFROST light and heat light are illuminated and the COOL light is also de-energized.

Figure 4.10 Defrost



The EEV and DUV are independently operated by the microprocessor. Complete schematics and legends are located in Section 9.

Defrost will terminate when the DTS reading rises above one of two model number configurable options selection, either an upper setting of 25.6°C (78°F) which is default or lower setting of 18°C (64°F).

When the DTS reading rises to the configured setting, the de-icing operation is terminated.

4.3.22 Defrost Related Settings

DTS Failure

When the return air temperature falls to 7°C (45°F), the controller ensures that the defrost temperature sensor (DTS) reading has dropped to 10°C or below. If it has not it indicates a failed DTS, a DTS failure alarm is triggered and the defrost mode is operated by the return temperature sensor (RTS). Defrost will terminate after 1 hour.

If the DTS fails to reach its termination setting, the defrost terminates after 2 hours of operation.

Defrost Timer

If CnF23 is configured to "SAV" (save), then the value of the defrost interval timer will be saved at power down and restored at power up. This option prevents short power interruptions from resetting an almost expired defrost interval, and possibly delaying a needed defrost cycle. If the save option is not selected the defrost timer will re-initiate and begin recounting.

If CnF11 is model number configured to OFF the operator will be allowed to choose "OFF" as a defrost interval option.

If CnF64 is configured in the operator will be allowed to choose "PuLS" as a defrost interval option. For units operating with "PuLS" selected, defrost interval is determined by the unit temperature set point and the Evap Fan Pulsing Temp setting on the Trip Settings screen. When the unit temperature set point is equal to or less than the Evaporator Fan Pulsing Temperature Setting, the defrost interval is set to 6 hours. Otherwise, the defrost interval is determined using the Automatic Defrost Interval Determination logic. In either case, "PuLS" remains displayed in this function select code.

If any Auto Pretrip sequence is initiated, the Defrost Interval setting will be set to 'AUTO' unless CnF49 (OEM Reset) is set to "Custom" AND CnF64 (Evaporator Fan Pulsing Logic) configuration variable is set to IN, in which case the Defrost Interval setting on the Trip Settings screen will be set to "Pulse".

If defrost does not terminate correctly and temperature reaches the set point of the Heat Termination Thermostat (HTT) 54°C (130°F), the HTT will open to de-energize the heaters (AL059 & AL060). If the HTT does not open and termination does not occur within two hours, the controller will terminate defrost. AL060 will be activated to inform of a possible DTS failure.

4.4 PROTECTION MODES OF OPERATION

4.4.1 Evaporator Fan Operation

Opening of an evaporator fan internal protector will shut down the unit.

4.4.2 Failure Action

Function code Cd29 may be operator set to select the action the controller will take upon a system failure. The factory default is full system shutdown. Refer to **Table 4-5**.

4.4.3 Generator Protection

Function codes Cd31(Stagger Start, Offset Time) and Cd32 (Current Limit) may be operator set to control the start up sequence of multiple units and operating current draw. The factory default allows on demand starting (no delay) of units and normal current draw. Refer to **Table 4-5**.

4.4.4 Compressor High Temperature Protection

The controller continuously monitors compressor discharge pressure and temperature, and suction pressure. If discharge pressure or temperature rises above the allowed limit or suction pressure falls below the allowed limit, the compressor will be cycled off and on every 3 minutes. Condenser and evaporator fans will continue to operate during the compressor off cycle.

If high compressor dome temperature occurs, as measured by the CPDS, the controller will allow additional refrigerant to be released into the system in order to provide cooling to the evaporator coil and compressor dome. The controller is alerted to high compressor dome temperatures via the CPDS when ambient temperature is greater than 43.3°C, return air temperature is less than -17.5°C and the compressor discharge temperature is greater than 117.7°C.

Dome temperature control logic will disengage when return air temperature and ambient temperature return to allowed limits or when the compressor turns off.

4.4.5 Compressor Low Pressure Protection

If the suction pressure low limit is triggered, the DUV will energize to raise the suction pressure.

4.4.6 Perishable Mode - System Pressure Regulation

In perishable mode, system pressures may need to be regulated at ambient temperatures of 20°C (68°F) and below. Once below this ambient temperature, the condenser fan may cycle on and off based on limits imposed for discharge pressure. For extremely cold ambient temperatures, -18°C (0°F), heater cycling may occur within normal system operation based on discharge pressure limits.

4.4.7 Condenser Fan Override

When CnF17 (Discharge Temperature Sensor) is set to "In" and CnF48 (Condenser Fan Switch Override) is set to "On", the condenser fan switch override logic is activated. If condenser cooling water pressure is sufficient to open the water pressure switch (de-energizing the condenser fan) when water flow or pressure conditions are not maintaining discharge temperature, the logic will energize the condenser fan as follows:

1. If the DUV is less than 80% open when the controller calls for it to be 100% open, the condenser fan is energized. When the DUV is 100% open, the fan will de-energize.
2. If DPT reading is invalid or out of range (AL65), the condenser fan is energized and will remain energized until system power is cycled.
3. If the system is running on condenser fan override and the high pressure switch opens, the condenser fan is energized and will remain energized until the system power is cycled.

4.5 QUEST - CCPC

Compressor-Cycle Perishable Cooling (CCPC) is a method of temperature control used during steady-state perishable cooling that cycles the compressor on and off according to return air temperature.

To be eligible for steady-state control the unit must first complete a setpoint pulldown phase and a CCPC pull-down phase:

During setpoint pulldown supply air temperature is controlled according to the unit's nominal supply air setpoint.

During CCPC pulldown the supply air temperature is lowered somewhat relative to the nominal setpoint. Evaporator fans are forced to operate at high speed.

Steady-state CCPC control maintains the same lowered supply air temperature that was used during CCPC pulldown. The compressor cycles on and off according to return air high and low limits. Depending on the fan mode of operation selected, the evaporator fans may be programmed to run at low speed some or all of the time according to the control logic.

4.6 CONTROLLER ALARMS

Alarm display is an independent controller software function. If an operating parameter is outside of expected range or a component does not return the correct signals back to the controller, an alarm is generated. A listing of the alarms is provided in [Section 4.11](#).

The alarm philosophy balances the protection of the refrigeration unit and that of the refrigerated cargo. The action taken when an error is detected always considers the survival of the cargo. Rechecks are made to confirm that an error actually exists.

Some alarms requiring compressor shutdown have time delays before and after to try to keep the compressor on line. An example is alarm code "LO," (low main voltage), when a voltage drop of over 25% occurs, an indication is given on the display, but the unit will continue to run.

When an Alarm Occurs:

- a. The red alarm light will illuminate for alarm code numbers 15, 17, 20, 21, 22, 23, 24, 25, 26, and 27.
- b. If a detectable problem exists, its alarm code will be alternately displayed with the set point on the left display.
- c. The user should scroll through the alarm list to determine what alarms exist or have existed. Alarms must be diagnosed and corrected before the Alarm List can be cleared.

To Display Alarm Codes:

- a. While in the Default Display mode, press the ALARM LIST key. This accesses the Alarm List Display Mode, which displays any alarms archived in the alarm queue.
- b. The alarm queue stores up to 16 alarms in the sequence in which they occurred. The user may scroll through the list by depressing an ARROW key.
- c. The left display will show "AL##," where ## is the alarm number sequentially in the queue.

- d. The right display will show the actual alarm code. "AA##" will display for an active alarm, where "##" is the alarm code. Or "IA##" will display for an inactive alarm, see [Section 4.11](#).
- e. "END" is displayed to indicate the end of the alarm list if any alarms are active.
- f. "CLEAR" is displayed if all alarms are inactive. The alarm queue may then be cleared by pressing ENTER. The alarm list will clear and "-----" will be displayed.

NOTICE

AL26 is active when none of the sensors are responding. Check the connector at the back of the controller, if it is loose or unplugged, reconnect it, then run a Pre-trip test (P5) to clear AL26.

4.7 PRE-TRIP DIAGNOSTICS

Pre-trip Diagnostics is an independent controller function that suspends normal refrigeration controller activities and provides preprogrammed test routines. The test routine can be run in Auto Mode, which automatically performs a pre programmed sequence of tests, or Manual Mode, which allows the operator to select and run any of the individual tests.

! CAUTION

Pre-trip inspection should not be performed with critical temperature cargoes in the container.

! CAUTION

When the Pre-trip key is pressed economy, dehumidification and bulb mode will be deactivated. At the completion of the Pre-trip test, economy, dehumidification and bulb mode must be reactivated.

A Pre-trip test may be initiated by use of the keypad or via communication, but when initiated by communication the controller will execute the entire battery of tests (auto mode).

At the end of a Pre-trip test, the message "P," "rSLts" (pretest results) will be displayed. Pressing ENTER will allow the user to see the results for each of the sub-tests. The results will be displayed as "PASS" or "FAIL" for each test run to completion.

A detailed description of the Pre-trip tests and test codes is provided in [Table 4-6](#). Detailed operating instructions are provided in [Section 5.8](#).

4.8 DATACORDER

4.8.1 Description

Carrier Transicold "DataCORDER" software is integrated into the controller and serves to eliminate the temperature recorder and paper chart. DataCORDER functions may be accessed by keypad selections and viewed on the display module. The unit is also fitted with interrogation connections (see [Figure 4.1](#)) which may be used with the Carrier Transicold DataReader to download data. A personal computer with Carrier Transicold DataLINE software installed may also be used to download data and configure settings.

The DataCORDER consists of:

- Configuration Software
- Operational Software
- Data Storage Memory
- Real Time Clock (with internal battery backup)
- Six Thermistor Inputs
- Interrogation Connections
- Power Supply (battery pack)

The DataCORDER performs the following functions:

- a. Logs data at 15, 30, 60 or 120 minute intervals and stores two years of data (based on one hour interval).
- b. Records and displays alarms on the display module.
- c. Records results of Pre-trip testing.
- d. Records DataCORDER and temperature control software generated data and events as follows:
 - Container ID Change
 - Software Upgrades
 - Alarm Activity
 - Battery Low (battery pack)
 - Data Retrieval
 - Defrost Start and End
 - Dehumidification Start and End
 - Power Loss (with and without battery pack)
 - Power Up (with and without battery pack)
 - Remote Probe Temperatures in the Container (USDA Cold treatment and Cargo probe recording)
 - Return Air Temperature
 - Set Point Change
 - Supply Air Temperature
 - Real Time Clock Battery (Internal) Replacement

- Real Time Clock Modification
- Trip Start
- ISO Trip Header (When entered via Interrogation program)
- Economy Mode Start and End
- “Auto 1/Auto 2/Auto 3” Pre-trip Start and End
- Bulb Mode Start
- Bulb Mode Changes
- Bulb Mode End
- USDA Trip Comment
- Humidification Start and End
- USDA Probe Calibration
- Fresh Air Vent Position

4.8.2 DataCORDER Software

The DataCORDER Software is subdivided into Operational Software, Configuration Software, and the Data Memory.

a. Operational Software

The Operational Software reads and interprets inputs for use by the Configuration Software. The inputs are labeled Function Codes. Controller functions (see **Table 4-7**) which the operator may access to examine the current input data or stored data. To access these codes, do the following:

1. Press the ALT. MODE and CODE SELECT keys.
2. Press an arrow key until the left window displays the desired code number. The right window will display the value of this item for five seconds before returning to the normal display mode.
3. If a longer display time is desired, press the ENTER key to extend the display time to 30 seconds.

b. Configuration Software

The configuration software controls the recording and alarm functions of the DataCORDER. Reprogramming to the factory-installed configuration is achieved via a configuration card. Changes to the unit DataCORDER configuration may be made using the DataLINE interrogation software.

A list of the configuration variables is provided in **Table 4-2**. Descriptions of DataCORDER operation for each variable setting are provided in the following paragraphs.

4.8.3 Sensor Configuration (dCF02)

Two modes of operation may be configured, the Standard Mode and the Generic Mode.

a. Standard Mode

In the standard mode, the user may configure the DataCORDER to record data using one of seven standard configurations. The seven standard configuration variables, with their descriptions, are listed in **Table 4-3**.

The inputs of the six thermistors (supply, return, USDA #1, #2, #3 and cargo probe) and the humidity sensor input will be generated by the DataCORDER. See **Figure 4.11**.

NOTE

The DataCORDER software uses the supply and return recorder sensors (SRS, RRS). The temperature control software uses the supply and return temperature sensors (STS, RTS).

b. Generic Mode

The generic recording mode allows user selection of the network data points to be recorded. The user may select up to a total of eight data points for recording. A list of the data points available for recording follows. Changing the configuration to generic and selecting which data points to record may be done using the Carrier Transicold Data Retrieval Program.

1. Control mode
2. Control temperature
3. Frequency
4. Humidity
5. Phase A current
6. Phase B current
7. Phase C current
8. Main voltage
9. Evaporator expansion valve percentage
10. Discrete outputs (Bit mapped - require special handling if used)
11. Discrete inputs (Bit mapped - require special handling if used)
12. Ambient sensor
13. Evaporator temperature sensor
14. Compressor discharge sensor
15. Return temperature sensor (RTS)
16. Supply temperature sensor (STS)
17. Defrost temperature sensor
18. Discharge pressure transducer
19. Suction pressure transducer
20. Condenser pressure transducer
21. Vent position sensor (VPS)

4.8.4 Logging Interval (dCF03)

The user may select four different time intervals between data recordings. Data is logged at exact intervals in accordance with the real time clock. The clock is factory set at Greenwich Mean Time (GMT).

4.8.5 Thermistor Format (dCF04)

The user may configure the format in which the thermistor readings are recorded. The short resolution is a 1 byte format and the long resolution is a 2 byte format. The short requires less memory and records temperature with variable resolutions depending on temperature range. The long records temperature in 0.01°C (0.02°F) steps for the entire range.

Table 4–2 DataCORDER Configuration Variables

CONFIGURATION NO.	TITLE	DEFAULT	OPTION
dCF01	(Future Use)	--	--
dCF02	Sensor Configuration	2	2,5,6,9,54,64,94
dCF03	Logging Interval (Minutes)	60	15,30,60,120
dCF04	Thermistor Format	Short	Long
dCF05	Thermistor Sampling Type	A	A,b,C
dCF06	Controlled Atmosphere/Humidity Sampling Type	A	A,b
dCF07	Alarm Configuration USDA Sensor 1	A	Auto, On, Off
dCF08	Alarm Configuration USDA Sensor 2	A	Auto, On, Off
dCF09	Alarm Configuration USDA Sensor 3	A	Auto, On, Off
dCF10	Alarm Configuration Cargo Sensor	A	Auto, On, Off

Figure 4.11 Standard Configuration Download Report

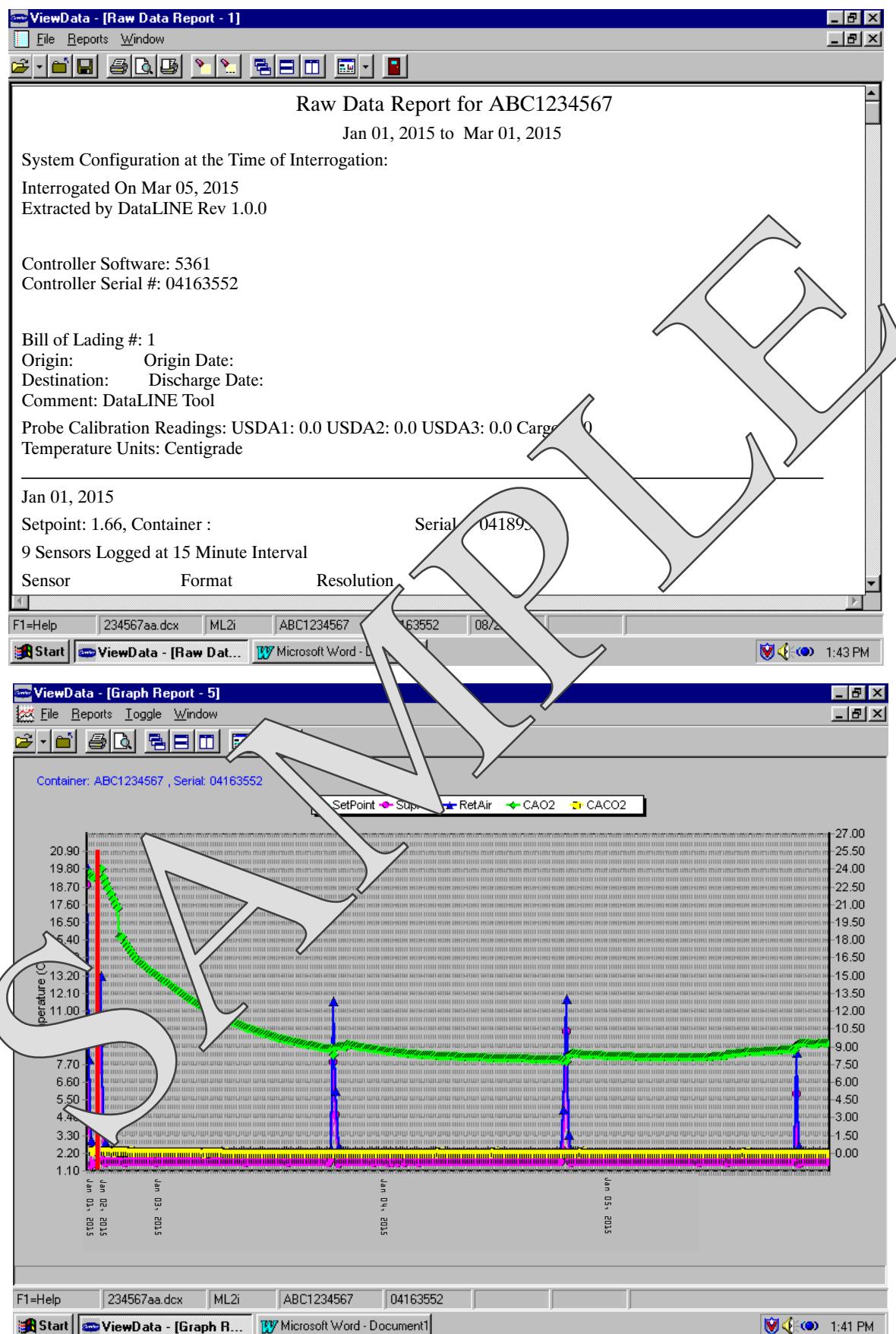


Table 4–3 DataCORDER Standard Configurations

Standard Config.	Description
2 sensors (dCF02=2)	2 thermistor inputs (supply & return)
5 sensors (dCF02=5)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs
6 sensors (dCF02=6)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 humidity input
9 sensors (dCF02=9)	Not Applicable
6 sensors (dCF02=54)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 cargo probe (thermistor input)
7 sensors (dCF02=64)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 humidity input 1 cargo probe (thermistor input)
10 sensors (dCF02=94)	2 thermistor inputs (supply & return) 3 USDA thermistor inputs 1 humidity input 1 cargo probe (thermistor input)

4.8.6 Sampling Type (dCF05 & dCF06)

Three types of data sampling are available: average, snapshot and USDA. When configured to average, the average of readings taken every minute over the recording period is recorded. When configured to snapshot, the sensor reading at the log interval time is recorded. When USDA is configured, supply and return temperature readings are averaged and the three USDA probe readings are snapshot.

4.8.7 Alarm Configuration (dCF07 - dCF10)

USDA and cargo probe alarms may be configured to OFF, ON or AUTO.

If a probe alarm is configured to OFF, the alarm for this probe is always disabled.

If a probe alarm is configured to ON, the associated alarm is always enabled.

If the probes are configured to AUTO, they act as a group. This function is designed to assist users who keep the DataCORDER configured for USDA recording, but do not install the probes for every trip. If all the probes are disconnected, no alarms are activated. As soon as one of the probes is installed, all of the alarms are enabled and the remaining probes that are not installed will give active alarm indications.

4.8.8 DataCORDER Power Up

The DataCORDER may be powered up in any one of four ways:

1. *Normal AC power:* The DataCORDER is powered up when the unit is turned on via the Stop-Start switch.
2. *Controller DC battery pack power:* If a battery pack is installed, the DataCORDER will power up for communication when an interrogation cable is plugged into an interrogation receptacle.
3. *External DC battery pack power:* A 12 volt battery pack may also be plugged into the back of the interrogation cable, which is then plugged into an interrogation port. No controller battery pack is required with this method.
4. *Real Time Clock demand:* If the DataCORDER is equipped with a charged battery pack and AC power is not present, the DataCORDER will power up when the real time clock indicates that a data recording should take place. When the DataCORDER is finished recording, it will power down.

During DataCORDER power-up, while using battery-pack power, the controller will perform a hardware voltage check on the battery. If the hardware check passes, the controller will energize and perform a software battery voltage check before DataCORDER logging. If either test fails, the real time clock battery power-up will be disabled until the next AC power cycle. Further DataCORDER temperature logging will be prohibited until that time.

An alarm will be generated when the battery voltage transitions from good to bad indicating that the battery pack needs recharging. If the alarm condition persists for more than 24 hours on continuous AC power, it indicates that the battery pack needs replacement.

4.8.9 Pre-trip Data Recording

The DataCORDER will record the initiation of a Pre-trip test (refer to [Section 4.7](#)) and the results of each test included in Pre-trip. The data is time-stamped and may be extracted via the Data Retrieval program. Refer to [Table 4–8](#) for a description of the data stored in the DataCORDER for each corresponding Pre-trip test.

4.8.10 DataCORDER Communications

Data retrieval from the DataCORDER can be accomplished by using the DataLINE, DataBANK Card, or a communications interface module.

NOTE

A DataLINE or a communications interface module display of Communication Failed is caused by faulty data transfer between the DataCORDER and the data retrieval device. Common causes include:

1. Bad cable or connection between DataCORDER and data retrieval device.
2. PC communication port(s) unavailable or mis-assigned.

Configuration identification for the models covered herein may be obtained on the Container Products Group Information Center by authorized Carrier Transcold Service Centers.

a. DataLINE

The DataLINE software for a personal computer is supplied on both floppy disks and CD. This software allows interrogation, configuration variable assignment, screen view of the data, hard copy report generation, cold treatment probe calibration and file management. Refer to Data Retrieval manual 62-10629 for a more detailed explanation of the DataLINE interrogation software. The DataLINE manual may be found on the Internet at www.container.carrier.com.

b. DataBANK™ Card

The DataBANK™ card is a PCMCIA card that interfaces with the controller through the programming slot and can download data at a fast rate. Files downloaded to DataBANK card files are accessible through an Omni PC Card Drive. The files can then be viewed using the DataLINE software.

c. Communications Interface Module

The communications interface module is a slave module, which allows communication with a master central monitoring station. The module will respond to communication and return information over the main power line.

With a communications interface module installed, all functions and selectable features that are accessible at the unit may be performed at the master station. Retrieval of all DataCORDER reports may also be performed. Refer to the master system technical manual for further information.

4.8.11 USDA Cold Treatment

Sustained cold temperature has been employed as a postharvest method for the control of fruit flies and other insect genera. The commodity, insect species, treatment temperatures and exposure times are found in sections T107, T108, and T109 of the USDA Treatment Manual.

In response to the demand to replace fumigation with this environmentally sound process, Carrier has integrated Cold Treatment capability into its microprocessor system. These units have the ability to maintain

supply air temperature within one quarter degree Celsius of set point and record minute changes in product temperature within the DataCORDER memory, thus meeting USDA criteria. Information on USDA is provided in the following sub-paragraphs.

a. USDA Recording

A special type of recording is used for USDA cold treatment purposes. Cold treatment recording requires three remote temperature probes be placed at prescribed locations in the cargo. Provision is made to connect these probes to the DataCORDER via receptacles located at the rear left-hand side of the unit. Four or five receptacles are provided. The four 3-pin receptacles are for the probes. The 5-pin receptacle is the rear connection for the Interrogator. The probe receptacles are sized to accept plugs with tricam coupling locking devices. A label on the back panel of the unit shows which receptacle is used for each probe.

The standard DataCORDER report displays the supply and return air temperatures. The cold treatment report displays USDA #1, #2, #3 and the supply and return air temperatures. Cold treatment recording is backed up by a battery so recording can continue if AC power is lost.

b. USDA/ Message Trip Comment

A special feature in DataLINE allows the user to enter a USDA (or other) message in the header of a data report. The maximum message length is 78 characters. Only one message will be recorded per day.

4.8.12 USDA Cold Treatment Procedure

The following is a summary of the steps required to initiate a USDA Cold Treatment.

If configured for USDA probes setup can be verified as follows (Refer to the Data Retrieval manual 62-10629 for more details):

1. Ensure the DataCorder is configured as (Refer to below):
 - a.DataCORDER is configured for USDA probes.
 - b.DataCORDER is set to logging interval for 60 minutes.
 - c.Sensor is set to "2 Averaged 3-USDA."
 - d.The resolution is set to "Normal."

Figure 4.12 DataCorder Configuration Screen

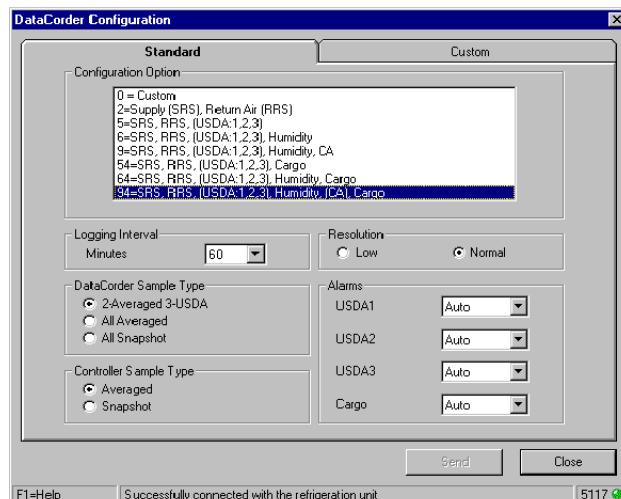
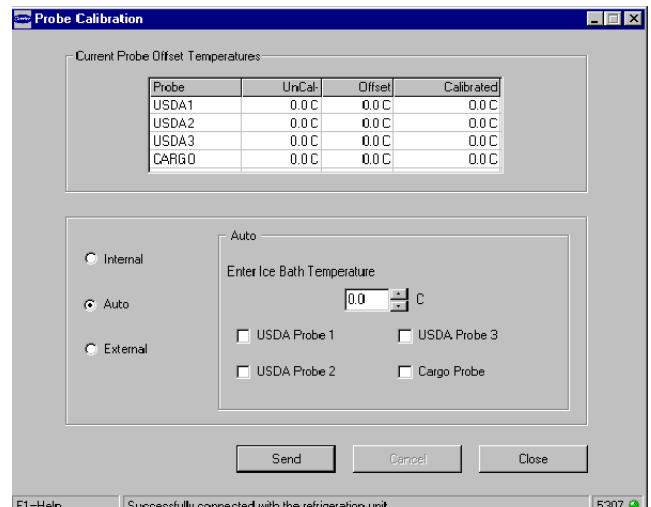


Figure 4.13 DataCorder Probe Calibration Screen



- Calibrate the three USDA probes by ice bathing the probes and performing the calibration function with the DataLINE. This calibration procedure generates the probe offsets which are stored in the controller and applied to the USDA sensors for use in generating sensor type reports.

Refer to the Data Retrieval manual 62-10629 for more details. (Refer to Figure below)

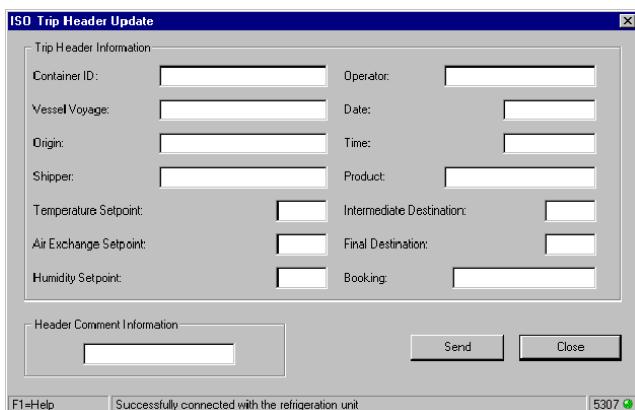
Sensor 1	Place the first sensor, labeled USDA1, in a box at the top of the stack of the fruit nearest to the air return intake.
Sensor 2	Place the second sensor, labeled USDA2, slightly aft of the middle of the container, halfway between the top and bottom of the stack.
Sensor 3	Place the third sensor, labeled USDA3, one pallet stack in from the doors of the container, halfway between the top and bottom of the stack.

- To initiate USDA recording, connect the personal computer and Enter ISO header information using the DataLINE software. (Refer to figure below and DataCorder Alarms Section)

a. Enter ISO header information.

b. Enter a trip comment if desired.

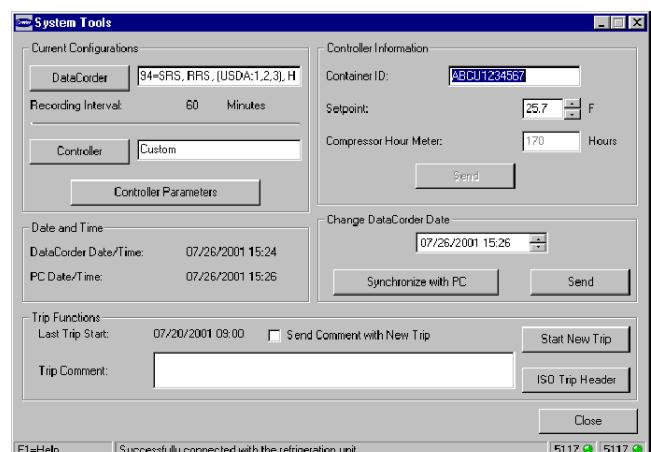
Figure 4.14 DataCorder Probe Calibration Screen



- Pre-cool the container to the treatment temperature or below.
- Install the DataCORDER module battery pack (if not already installed).
- Place the three probes. Refer to USDA Treatment Manual for directions on placement of probes in fruit and probe locations in container..

c. Using the System Tools screen in the DataLine software perform a "trip start." (Refer to figure below)

Figure 4.15 DataCorder Systems Tool Screen



4.8.13 DataCORDER Alarms

The alarm display is an independent DataCORDER function. If an operating parameter is outside of the expected range or a component does not return the correct values to the DataCORDER, an alarm is generated. The DataCORDER contains a buffer of up to eight alarms. A listing of the DataCORDER alarms is provided in **Table 4-9**. Refer to **Section 4.8.7** for configuration information.

To display alarm codes:

- a. While in the Default Display mode, press the ALT. MODE&ALARMLIST keys. This accesses the DataCORDER Alarm List Display Mode, which displays any alarms stored in the alarm queue.
- b. To scroll to the end of the alarm list, press the UP ARROW. Depressing the DOWN ARROW key will scroll the list backward.
- c. The left display will show "AL#" where # is the alarms number in the queue. The right display will show "AA##," if the alarm is active, where ## is the alarm number. "IA##," will show if the alarm is inactive
- d. "END" is displayed to indicate the end of the alarm list if any alarms are active. "CLEAr" is displayed if all the alarms in the list are inactive.
- e. If no alarms are active, the alarm queue may be cleared. The exception to this rule is the DataCORDER alarm queue Full alarm (AL91), which does not have to be inactive in order to clear the alarm list. To clear the alarm list:
 1. Press the ALT. MODE & ALARM LIST keys.
 2. Press the UP/DOWN ARROW key until "CLEAr" is displayed.
 3. Press the ENTER key. The alarm list will clear and "----" will be displayed.

4. Press the ALARM LIST key. "AL" will show on the left display and "----" on the right display when there are no alarms in the list.
5. Upon clearing of the alarm queue, the alarm light will be turned off.

4.8.14 ISO Trip Header

DataLINE provides the user with an interface to view/modify current settings of the ISO trip header through the ISO Trip Header screen.

The ISO Trip Header screen is displayed when the user clicks on the "ISO Trip Header" button in the "Trip Functions" Group Box on the System Tools screen.

F9 function - Provides the user with a shortcut for manually triggering the refresh operation. Before sending modified parameter values, the user must ensure that a successful connection is established with the controller.

If the connection is established with the DataCORDER, the current contents of the ISO Trip Header from the DataCORDER will be displayed in each field. If the connection is not established with the DataCORDER, all fields on the screen will be displayed as "Xs." If at any time during the display of the ISO Trip Header screen the connection is not established or is lost, the user is alerted to the status of the connection.

After modifying the values and ensuring a successful connection has been made with the DataCORDER, click on the "Send" button to send the modified parameter values.

The maximum allowed length of the ISO Trip Header is 128 characters. If the user tries to refresh the screen or close the utility without sending the changes made on the screen to the DataCORDER, the user is alerted with a message.

4.9 CONTROLLER CONFIGURATION VARIABLES

Table 4–4 Controller Configuration Variables

CONFIGURATION NUMBER	TITLE	DEFAULT	OPTION
CnF02	Evaporator Fan Speed	dS (Dual)	SS (Single)
CnF03	Control Temperature Sensors	FOUr	duAL
CnF04	Enable Dehumidification	On	OFF
CnF08	Evaporator Motor Type	1Ph	3Ph
CnF09	Refrigerant Type	r134a	r744
CnF11	Defrost “Off” Selection	noOFF	OFF
CnF15	Enable Discharge Temperature Sensor	Out	In
CnF16	Enable DataCORDER	On (Yes)	(Not Allowed)
CnF17	Enable Discharge Pressure Transducer	Out (No)	In (Yes)
CnF18	Heater Type	Old (Low Watt)	nEW (High Watt)
CnF20	Enable Suction Pressure Transducer	Out (No)	In (Yes)
CnF22	Economy Mode	OFF	Std, Full
CnF23	Enable Defrost Interval Save	noSAv	SAv
CnF24	Enable Long Pre-trip Test Series	Auto	Auto2, Auto 3
CnF25	Enable Pre-trip Data Recording	rSLtS	dAtA
CnF26	Heat Lockout Temperature	Set to -10C	Set to -5C
CnF27	Enable Suction Temperature Sensor	Out	In
CnF28	Enable Bulb Mode	NOr	bULb
CnF31	Probe Check	SPEC	Std
CnF32	Enable Single Evaporator Fan Option	2EF0	(Not Allowed)
CnF33	Enable Snap Freeze	OFF	SnAP
CnF34	Temperature Unit Display	nOth	F
CnF37	Electronic Chart Probe	rEtUR	SUPPL, bOth
CnF41	Enable Low DTT Setting	Out	In
CnF44	Autoslide Enable	Out	LO, UP
CnF45	Low Humidity Enabled	Out	In
CnF46	Quench/liquid Injection Valve Type	nO=0=no	nC=1=nc
CnF47	Vent Position	OFF	UP, LOW, CUSTOM
CnF49	OEM Reset Option	OFF	0-off, 1-std, 2-spec, 3-cust
CnF50	Enhanced Bulb Mode Interface	0-out	1-in
CnF51	Timed Defrost Disable	0-out	1-in
CnF52	Oil Return Algorithm	0-out	1-in
CnF53	Water Cool Oil Return Logic	0-out	1-in
CnF55	TXV Boost Relay	0-out	1-in
CnF56	TXV Boost Circuit	0-out	1-in
CnF57	PWM Compressor Control	0-out	1-in
CnF59	Electronic Evaporator Expansion Valve	0-none	1-EC, 2-KE, 3- NA
CnF61	ACT ASC Control Enable	0-out	1-in
CnF62	Extended Temperature Control Enable	0-out	1-in
CnF63	CCPC Pre-trip/Tripstart Default State	0-on	1-off
CnF64	Enable Fan Pulsing Logic	0-in	1-out
CnF66	High Speed Evaporator Fan Option	0-off	1-on
CnF67	Air Heaters	0-out	1-in
CnF68	Enable Default Pulsing Temperature	0-out	1-in

Note: Configuration numbers not listed are not used in this application. These items may appear when loading configuration software to the controller but changes will not be recognized by the controller programming.

4.10 CONTROLLER FUNCTION CODES

Table 4–5 Controller Function Codes

Code No.	Title	Description
NOTICE		
Note: If the function is not applicable, the display will read “-----”		
Display Only Functions - Cd01 through Cd26 are display only functions.		
Display Only Functions		
Cd01	Digital Unloader Valve Closed (%)	Displays the DUV percent closed. The right display reads 100% when the valve is fully closed. The valve will usually be at 10% on start up of the unit except in very high ambient temperatures.
Cd03	Compressor Motor Current	The current sensor measures current draw in lines L1 & L2 by all of the high voltage components. It also measures current draw in compressor motor leg T3. The compressor leg T3 current is displayed.
Cd04	Line Current, Phase A	The current sensor measures current on two legs. The third unmeasured leg is calculated based on a current algorithm. The current measured is used for control and diagnostic purposes. For control processing, the highest of the Phase A and B current values is used for current limiting purposes. For diagnostic processing, the current draws are used to monitor component energization. Whenever a heater or a motor is turned ON or OFF, the current draw increase/reduction for that activity is measured. The current draw is then tested to determine if it falls within the expected range of values for the component. Failure of this test will result in a Pre-trip failure or a control alarm indication.
Cd05	Line Current, Phase B	
Cd06	Line Current, Phase C	
Cd07	Main Power Voltage	The main supply voltage is displayed.
Cd08	Main Power Frequency	The value of the main power frequency is displayed in Hertz. The frequency displayed will be halved if either fuse F1 or F2 is bad (alarm code AL21).
Cd09	Ambient Temperature	The ambient sensor reading is displayed.
Cd10	Evaporator Temperature Sensor	Evaporator temperature sensor reading is shown on the right display.
Cd11	Compressor Discharge Temperature	Compressor discharge temperature sensor reading, using compressor dome temperature, is displayed.
Cd12	Compressor Suction Pressure	Reading for evaporator pressure transducer (EPT) is shown on the left display; Press ENTER at Cd12 to show reading for compressor suction port pressure on right display.
Cd14	Compressor Discharge Pressure	Compressor discharge pressure transducer reading is displayed.
Cd15	Digital Unloader Valve	The status of the valve is displayed (Open - Closed).
Cd16	Compressor Motor Hour Meter/Unit Run Time Hour Meter	This code displays the compressor motor hours. User can view unit run time by pressing the ENTER key while in Cd16. Total hours are recorded in increments of 10 hours (i.e., 3000 hours is displayed as 300). The Compressor Motor Hour Meter display can be reset to 0 by pressing and holding the ENTER key for 5 seconds. The Unit Run Time Hour Meter cannot be reset.
Cd17	Relative Humidity %	Humidity sensor reading is displayed. This code displays the relative humidity, as a percent value.
Cd18	Software Revision #	The software revision number is displayed.
Cd19	Battery Check	This code checks the Controller/DataCORDER battery pack. While the test is running, “btest” will flash on the right display, followed by the result. “PASS” will be displayed for battery voltages greater than 7.0 volts. “FAIL” will be displayed for battery voltages between 4.5 and 7.0 volts, and “-----” will be displayed for battery voltages less than 4.5 volts. After the result is displayed for four seconds, “btest” will again be displayed, and the user may continue to scroll through the various codes.

Table 4–5 Controller Function Codes

Code No.	Title	Description
Cd20	Config/Model #	This code indicates the dash number of the model for which the Controller is configured (i.e., if the unit is a 69NT40-551-100, the display will show "51100"). To display controller configuration database information, press ENTER. Values in "CFYYMMDD" format are displayed if the controller was configured with a configuration card or with a valid OEM serial port configuration update; YYMMDD represents the publication date of the model configuration database.
Cd21	Capacity Mode	The mode of operation is displayed (Unloaded - Standard - Economized).
Cd22	Compressor State	The status of the compressor is displayed (OFF, On).
Cd23	Evaporator Fan	Displays the current evaporator fan state (OFF, LOW, HIGH).
Cd25	Compressor Run Time Remaining Until Defrost	This code displays the time remaining until the unit goes into defrost (in tenths of an hour). This value is based on the actual accumulated compressor running time.
Cd26	Defrost Temperature Sensor Reading	Defrost temperature sensor reading is displayed.
Configurable Functions - Cd27 through Cd37 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.		
Cd27	Defrost Interval (Hours or Automatic)	<p>This is the desired period of time between defrost cycles. Factory default is 3 hours. Refer to Section NO TAG for information on Defrost Interval.</p> <p>CnF11 determines whether the operator will be allowed to chose "OFF" as a defrost interval option.</p> <p>CnF64 determines whether the operator will be allowed to choose "PuLS" as a defrost interval option. For units operating with "PuLS" selected, defrost interval is determined by the unit temperature setpoint and the Evaporator Fan Pulsing Temperature Setting (Cd60). When the unit temperature setpoint is equal to or less than the Evaporator Fan Pulsing Temperature Setting, the defrost interval is set to 6 hours. Otherwise, the defrost interval is determined using the Automatic Defrost Interval Determination logic. In either case, "PuLS" remains displayed in this function select code.</p> <p>After a new Defrost Interval is selected, the previously selected Interval is used until the next defrost termination, the next time the DTT contacts are OPEN, or the next time power to the control is interrupted. If the previous value or the new value is "OFF", the newly selected value will be used immediately.</p> <p>If any Auto Pretrip sequence is initiated, Cd27 will be set to 'AUTO' unless CnF49 (OEM Reset) is set to "Custom" AND CnF64 (Evaporator Fan Pulsing Logic) configuration variable is set to IN, in which case Cd27 will be set to "PuLS".</p>
Cd28	Temperature Units (Degrees C or Degrees F)	This code determines the temperature units (C or F) that will be used for all temperature displays. The user selects C or F by selecting function code Cd28 and pushing the ENTER key. The factory default value is Celsius units. This function code will display "----" if CnF34 is set to F.
Cd29	Failure Action (Mode)	If all of the control sensors are out of range (alarm code AL26) or there is a probe circuit calibration failure (alarm code AL27), the unit will enter the shutdown state defined by this setting. The user selects one of four possible actions as follows:
		A - Full Cooling (Compressor is on, economized operation.)
		b - Partial Cooling (Compressor is on, standard operation.)
		C - Evaporator Fan Only (Evaporator fans on high speed, not applicable with frozen set points.)
		d - Full System Shutdown - Factory Default (Shut down every component in the unit.)

Table 4–5 Controller Function Codes

Code No.	Title	Description
Cd30	In-Range Tolerance	<p>The in-range tolerance will determine the temperature band around the set point which will be designated as in-range.</p> <p>For normal temperature control, control temperature is considered in range if it is within setpoint in-range Tolerance. There are four possible values:</p> <p>1 = +/- 0.5°C (+/-0.9°F) 2 = +/- 1.0°C (+/-1.8°F) 3 = +/- 1.5°C (+/-2.7°F) 4 = +/- 2.0°C (+/-3.6°F) - Factory Default</p> <p>If the control temperature is in-range, the green IN-RANGE light will be illuminated.</p> <p>In-range tolerance shall be set to +/- 2.0°C upon activation of dehumidification or bulb mode (Cd33, Cd35, Cd48).</p> <p>When CCPC is actively controlling, in-range tolerance is not considered.</p> <p>"----" will be displayed whenever Dehumidification or Bulb mode is enabled or when CCPC with six hour re-activation is actively controlling.</p> <p>"----" will be displayed whenever Frozen Economy Mode is operating.</p>
Cd31	Stagger Start Offset Time (Seconds)	The stagger start offset time is the amount of time that the unit will delay at start-up, thus allowing multiple units to stagger their control initiation when all units are powered up together. The eight possible offset values are 0 (Factory Default), 3, 6, 9, 12, 15, 18 or 21 seconds.
Cd32	Current Limit (Amperes)	The current limit is the maximum current draw allowed on any phase at any time. Limiting the unit's current reduces the load on the main power supply. When desirable, the limit can be lowered. Note, however, that capacity is also reduced. The five values for 460 VAC operation are: 15, 17, 19, 21, or 23 amperes. The factory default setting is 21 amperes.
Cd33	Humidity Setpoint	This is the value in percent to which the system will dehumidify or humidify. There are configuration variables that determine whether dehumidification/humidification capabilities are installed. In the test mode, the setpoint will be temporarily set to 1%, allowing the test of dehumidification. After 5minutes, the normal setpoint is restored. If unit is configured for HUMIDIFICATIONMODE then selection of a setpoint greater than 75% will activate humidification, and a setpoint less than or equal to 75% will activate dehumidification. If the unit is configured for dehumidification only, then the entire setpoint range will apply to dehumidification. If Pretrip is initiated, this value will be set to "OFF" automatically. <small>(Replaced by Cd48 interface if CnF50 Enhanced Bulb Mode Interface is active.)</small>
Cd34	Economy Mode (On-Off)	The current state of the economy mode option, "----", On, or Off. CnF22 determines whether economy mode offered. Economy mode is a user selectable mode of operation provided for power saving purposes.
Cd35	Bulb Mode	<p>The current state of the bulb mode option, "----", nOr, or bULb. <small>(Replaced by Cd48 if CnF50, Enhanced Bulb Mode, is active.)</small></p> <p>Bulb mode is an extension of dehumidification control (Cd33). If dehumidification (CnF04) is set to "Off," Cd35 will display "Nor" and the user will be unable to change it. CnF28 determines whether the bulb mode selection is offered.</p> <p>After a dehumidification set point has been selected and entered for code Cd33, the user may then change Cd35 to "bulb." After Bulb Mode has been selected and entered, the user may then utilize function codes Cd36 and Cd37 to make the desired changes.</p>
Cd36	Evaporator Fan Speed Select	<p>This is the desired evaporator fan speed for use during the bulb Dehumidification and Humidification mode option. <small>(Replaced by Cd48 if CnF50, Enhanced Bulb Mode, is active.)</small></p> <p>This code is enabled only if in the dehumidification mode (Cd33) and bulb mode (Cd35) has been set to "bulb." If these conditions are not met, "alt" will be displayed (indicating that the evaporator fans will alternate their speed) and the display cannot be changed.</p> <p>If a dehumidification set point has been selected along with bulb mode then "alt" may be selected for alternating speed, "Lo" for low speed evaporator fan only, or "Hi" for high speed evaporator fan only.</p> <p>If a setting other than "alt" has been selected and bulb mode is deactivated in any manner, then selection reverts back to "alt."</p>
Cd37	Variable DTT Setting (Bulb Mode)	This is the variable defrost termination thermostat setting to be used with the optional bulb mode functionality. This item is only displayed if the bulb mode option is configured on. <small>(Replaced by Cd48 interface if CnF50 Enhanced Bulb Mode Interface is active.)</small>

Table 4–5 Controller Function Codes

Code No.	Title	Description
Display Only Functions - Cd38 through Cd40 are display only functions.		
Cd38	Secondary Supply Temperature Sensor	Cd38 will display the current supply recorder sensor (SRS) reading for units configured for four probes. If the unit is configured with a DataCORDER, Cd38 will display “----.” If the DataCORDER suffers a failure, (AL55) Cd38 will display the supply recorder sensor reading.
Cd39	Secondary Return Temperature Sensor	Cd39 will display the current return recorder sensor (RRS) reading for units configured for four probes. If the unit is configured with a DataCORDER, Cd39 will display “----.” If the DataCORDER suffers a failure, (AL55) Cd39 will display the return recorder sensor reading.
Cd40	Container Identification Number	If a valid container id exists, the default display for Cd40 will be “cd40_XXXXX” where “XXXXX” is the 5th character through the 9th character of the container id. Pressing the Enter key on Cd40 will display “id_YYYYYYYY” where “YYYYYYYY” is the 5th character to the 11th character of the container id. If no valid container id exists or the container id is blank, the default display will have Cd40 on the left display and the right display will alternate between “_nEEd” and “__ id”. Pressing the enter key while on Cd40 in the state will prompt the Set Id Interface. On start up if the container id is not valid, Cd40 will be brought up on the display for the first minute of power up. This can be left by either entering a container id or leaving the code select normally. Cd40 is configured at commissioning to read a valid container identification number. The reading will not display alpha characters; only the numeric portion of the number will display.
Cd41	Valve Override	SERVICE FUNCTION: This code is used for troubleshooting, and allows manual positioning of the economizer solenoid valve, electronic expansion valve, and digital unloader valve. Provides readings such as: Percent Capacity, EEV, Capacity Mode, LIV and DUV. Refer to Section 7.21 for operating instructions.
Configurable Functions - Cd43 is a user-selectable function. The operator can change the value of this function to meet the operational needs of the container.		
Cd43	eAutoFresh Mode	Cd43 is a user selectable mode of operation that allows the opening and closing of a mechanical air vent door via a stepper motor. These selection modes are as follows: OFF - Air makeup vent will remain closed. USER - Allows for manual selection of the setting. DELAY - The opening of the door is based on selected time, return temperature and flow rate (percent opened). gASLM - The opening is based percent open and CO ₂ and O ₂ selectable limits (LM). This selection is only active if the unit has a CO ₂ sensor. TEST / CAL (CO ₂ sensor option units only) - The door will fully open and close to allow the user to inspect its operation. If CAL is selected, the controller will zero calibrate the CO ₂ sensor input. If the unit is not configured with AutoFresh, the Cd43 will display “----” Refer to Section 5.4.3 for description of operational parameters.
Display Only Function - Cd44 is a display only function.		
Cd44	eAutoFresh Values / CO ₂ Sensor Status	Code Cd44 displays the eAutoFresh CO ₂ and O ₂ values (CO ₂ and O ₂) and CO ₂ and O ₂ limits (CO ₂ LIM and O ₂ LIM), respectively. This function code will be dashed out if not configured for eAutofresh. This function code will be dashed if CO ₂ sensor is not detected, and a sensor is not expected (didn't have one previously). This function code will display “ChECK” if a CO ₂ sensor has not been auto-detected at the most recent power-up and was detected at a previous power-up. If “ChECK” is displayed and the ENTER key is pressed, “SEnSr” is displayed with the choices of “YES” and “no”:“YES” – sensor should be remembered as detected (present) “no” – sensor should not be remembered as being detected (not present)
Configurable Functions - Cd45 through Cd48 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.		

Table 4–5 Controller Function Codes

Code No.	Title	Description
Cd45	Vent Position Sensor (VPS) Position	Values: 0 to 240 for UPPER / 0 to 225 for LOWER This function code will be dashed out if not configured for VPS. When configured for VPS, Cd45 displays the current vent position in units of 5 CMH (units displayed as "CM") or CFM (units displayed as "CF") depending on the selection of Cd46 (Airflow display units), Cd28 (Metric/Imperial) or the pressing of the deg C/F key. Cd45 will display whenever the control detects movement via the sensor unless AL50 is active. Cd45 will display for 30 seconds, then time out and return to the normal display mode.
Cd46	Airflow Display Units	Selects the airflow units to be displayed by Cd45 if configured for Vent Position Sensor or displayed by "USER/FLO" under Cd43 if configured for Autoslide. CF= Cubic Feet per Minute CM=Cubic Meters per Hour bOth=Displays CF or CM depending on the setting of Cd28 (Metric/Imperial) or the pressing of the degree C/F key.
Cd47	Variable Economy Temperature Setting	Used when Economy Mode (CnF22) is set to 3- cust. Display will show "----" when the unit is not configured for Economy Mode. When the unit has a perishable setpoint and Economy Mode is active, at the start of each cooling or heating cycle, high speed evaporator fans will run for 3 minutes. After three minutes, the evaporator fans will be switched to low speed any time that the supply temperature is within +/- 0.25°C of the setpoint and the return temperature is less than or equal to the supply temperature + the user selected Cd47 (values are 0.5°C - 4.0°C, default is 3.0°C).

Table 4–5 Controller Function Codes

Code No.	Title	Description
Cd48	Dehumidification / Bulb Cargo Mode Parameter Selection	<p>Initially Cd48 will display current dehumidification-mode; bUlB - bulb cargo mode, dEhUM - normal dehumidification, or OFF - off. This display is steady.</p> <p>Pressing ENTER key will take the interface down into a hierarchy of parameter selection menus (mode, setpoint, evaporator speed, DTT setting). Pressing ENTER key in any parameter selection menu commits to selection of the currently displayed parameter and causes the interface to descend into the next parameter selection menu. All parameter selection menus alternate between a blank display and the current selection in the right hand display.</p> <p>Pressing CODE SELECT key in a selection menu cancels the current selection activity and ascends back up to the next higher selection menu (or to Cd48 display mode if that is the next higher).</p> <p>If the operator does not press any key for five seconds the interface reverts to normal system display and the current selection menu is cancelled, but any previously committed changes are retained.</p> <p>Available parameters and parameter ranges are a function of configuration options and previously selected parameters as indicated above.</p> <p>Whenever any pretrip test is initiated, dehumidification-mode goes to OFF.</p> <p>Whenever dehumidification-mode goes to OFF:</p> <ul style="list-style-type: none"> • Dehumidification control setpoint goes to 0%RH internally but will then initialize to 95% RH when dehumidification-mode leaves OFF. • Evaporator speed select goes to Alt for units without PWM Compressor Control (Cnf57 = Out), Evaporator speed select goes to Hi for units with PWM Compressor Control (Cnf57 = In). • DTT setting goes to 25.6_C or 18.0_C, depending on Cnf41. <p>Whenever dehumidification-mode is set to bUlB, DTT setting goes to 18.0°C if it had been set higher.</p> <p>Whenever dehumidification-mode is set to dEhUM, DTT setting goes to 25.6°C or 18.0°C, depending on Cnf41.</p> <p>For units without PWM Compressor Control (Cnf57 = Out):</p> <ul style="list-style-type: none"> • Whenever dehumidification control setpoint is set below 65% RH evaporator speed select goes to LO if it had been set to Hi. • Whenever dehumidification control setpoint is set above 64% RH evaporator speed select goes to Alt if it had been set to LO. <p>For units with PWM Compressor Control (Cnf57 = In):</p> <ul style="list-style-type: none"> • Whenever dehumidification control set point is set below 60% RH, the evaporator fan speed is set to LO, the user has the ability to set the evaporator fan speed to Hi via the keypad. • Whenever dehumidification control set point is set equal to or above 60% RH, the evaporator fan speed is set to Hi, the user has the ability to set the evaporator fan speed to LO via the keypad.
Display Only Function - Cd49 is a display only function.		
Cd49	Days Since Last Successful Pre-trip	<p>Displays the number of days since last successful pretrip sequence.</p> <p>Press ENTER to view the number of days since the last successful pretrip for Auto1, Auto2, and Auto3 in sequence.</p> <p>Press CODE SELECT to step back through the list and ultimately to exit the Cd49 display.</p>
Configurable Functions - Cd50 through Cd53 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.Cd50		

Table 4–5 Controller Function Codes

Code No.	TITLE	DESCRIPTION
Cd50	CCPC Disabled	<p>"OFF" = disabled. "On" = enabled. "SEtPt" = suspended by setpoint too low. "CAHUM" = suspended by CA or humidity control. "ACT" = suspended by ACT active. "FAIL" = all return temperature probe failure for CCPC. "PrtrP" = pretrip active. "C LIM" = suspended by cool limit logic. "PULL" = pulldown active. "ALARm" = suspended by shutdown alarm Press enter, arrow keys, and then enter to select "OFF" or "On". If "On" is selected, CCPC operation may be suspended as indicated by one of the suspension codes listed above. If CCPC is not "OFF" and is not suspended, "On" will be displayed.</p>
Cd51	Automatic Cold Treatment Parameter Selection	<p>ACT-mode: Cd51 increments of (1 day)_(1hr), Display: default "0_0 " "done" mm-dd this will be display is ACT has completed "ACT" value "On" "OFF" or "----"Display /Select: default "OFF" "trEAt" value °C / °F on 0.1 degree increments Display>Select: default "0.0°C" "DAyS" value "0 – 99" increments of 1 Display>Select: default "0" "ProbE" value Probe positions ex '1 2 _ 4' '1 _ 3 _' Display: default "----" "SPnEW" value °C / °F on 0.1° increments Display>Select: default "10.0°C " Initially Cd51 will display current countdown timer increments of (1 day)_(1hr), default "0_0 Pressing ENTER key will take the interface down into a hierarchy of parameter selection menus (act, treat, days, probe and spnew setting). Pressing ENTER key in any of the parameter selection menus commits to selection of the currently displayed parameter and causes the interface to descend into the next parameter selection menu. All parameter selection menus alternate between a blank display and the current selection in the right hand display. Pressing CODE SELECT key in a selection menu cancels the current selection activity and ascends back up to the next higher selection menu (or to Cd51 display mode if that is the next higher). If the operator does not press any key for five seconds the interface reverts to normal system display and the current selection menu is cancelled, but any previously committed changes are retained. Available parameters and parameter ranges are a function of configuration options and previously selected parameters as indicated above. Parameter with the exception of "Act" may not be altered if Cd51 is re-entered if "Act" is "On". When ACT has completed including reaching the new setpoint "done" on the left display and the MONTH DAY of completion on the right display will be displayed as the second entry in the menu. Turning ACT off clears this entry. This action also resets Cd51 to initial time remaining. ACT must then be turned on to view or modify the additional parameters. Whenever any auto Pre-trip test or Trip Start is initiated, ACT mode goes to OFF.</p>

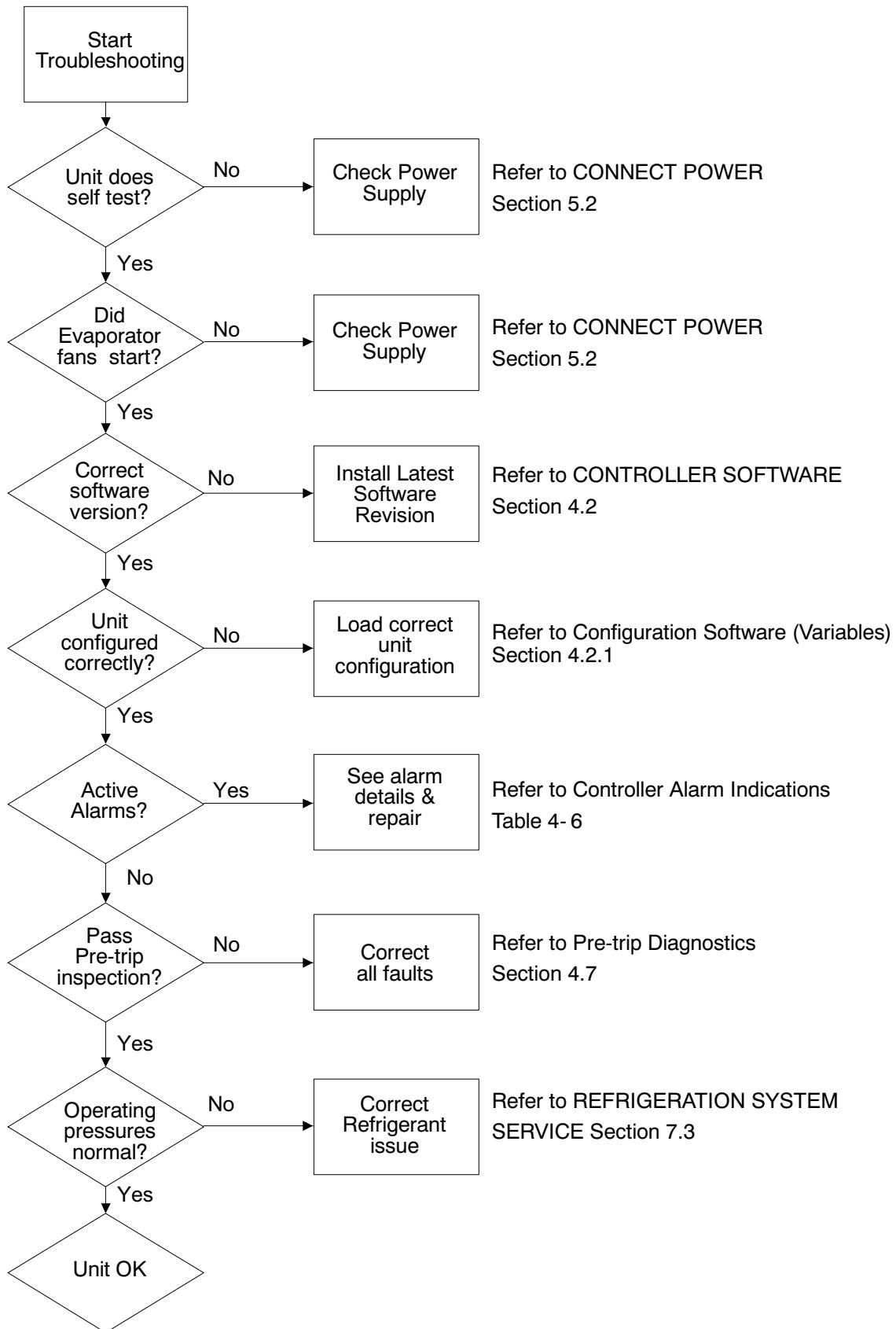
Table 4–5 Controller Function Codes

Code No.	Title	Description
Cd53	Automatic Set point Change Mode Parameter Selection	<p>ASC-mode: Cd53 increments of (1 day)_(1hr), Display: default “0_0 “ “done” mm-dd this will be display is ASC has completed “ASC” value “On” “OFF” Display /Select: default “OFF” “nSC” value “1 - 6” (This is the value “n” for the subsequent entries). “SP (n-1)” value °C / °F on 0.1 degree increments Display/Select: default “10.0°C” “DAY (n-1)” value “1 – 99” increments of 1 Display>Select: default “1” “SP (n)” value °C / °F on 0.1 degree increments Display>Select: default “10.0°C” Initially Cd53 will display current count down timer increments of (1 day)_(1hr), default “0_0” Pressing ENTER key will take the interface down into a hierarchy of parameter selection menus, (mode, act, treat, days, probe and spnew setting). Pressing ENTER key in any of the parameter selection menus selects the currently displayed parameter and causes the interface to descend into the next parameter selection menu. All parameter selection menus alternate between a blank display and the current selection in the right hand display. Pressing CODE SELECT key in a selection menu cancels the current selection activity and ascends back up to the next higher selection menu (or to Cd53 display mode if that is the next higher). If the operator does not press any key for five seconds the interface reverts to normal system display and the current selection menu is cancelled, but any previously committed changes are retained. Available parameters and parameter ranges are a function of configuration options and previously selected parameters as indicated above. Parameter with the exception of “ASC” may not be altered if Cd53 is re-entered if “ASC” is “On”. When ASC has completed including reaching the last setpoint “done” on the left display and the MONTH DAY of completion on the right display will be displayed as the second entry in the menu. Turning ASC off clears this entry. This action also resets Cd53 to initial time remaining. ASC must then be turned on to view or modify the additional parameters. Whenever any auto pretrip test or Trip Start is initiated, ASC mode goes to OFF.</p>
Display Only Functions - Cd54 through Cd58 are display only functions.		
Cd54	Suction Port Superheat / Electronic Expansion Valve Status	Reading for evaporator superheat (suction temperature minus suction saturation temperature as calculated from suction pressure) is shown on the right display. Press ENTER at Cd54 to show reading for EEV position (in %) on left display.
Cd55	Discharge Superheat	Cd55 will display discharge superheat (discharge temperature minus discharge saturation temperature as calculated from discharge pressure) values in C /F as calculated by the discharge temperature minus the discharge saturation temperature as calculated from discharge pressure. “----” will be displayed if selection is not valid.
Cd58	Water Pressure Switch / Condenser Fan Switch State or Override Logic State	<p>Cd58 will display “CLOSE” if the WPS or CFS switch contacts are closed or if these options are not installed. “OPEN” is displayed when the WPS or CFS switch contacts are open. When the WPS/CFS Override Logic is “TRUE”, the right display will flash on all units.</p> <p>NOTE:</p> <ol style="list-style-type: none"> 1. This CLOSE/OPEN state displayed in this Code Select function only applies to units that have the ability to detect the state of a WPS/CFS. This function should not be relied upon to display the condition of the switch on units that don't have a WPS/CFS switch connected to ECG2 exclusively. 2. The right display will flash if the WPS/CFS Override Logic is TRUE on all units. This is always the case, whether the unit has a WPS or CFS installed or not. 3. The ability of the WPS/CFS Override Logic to control the condenser fan is limited. It is not possible for this logic to control the fan on units that have the WPS or CFS wired in series with the fan contactor. Units wired in this configuration can indicate that the WPS/CFS Override Logic is active by flashing the right display, however, the wiring will not allow for control of the condenser fan.
Configurable Functions - Cd59 through Cd61 are user-selectable functions. The operator can change the value of these functions to meet the operational needs of the container.		

Table 4–5 Controller Function Codes

Code No.	Title	Description
Cd59	Pump Down Logic	<p>Cd59 allows operation of the pump down logic control. The display will flash between “STArT PdN” and “PrESS EnTER”. Upon entering Cd59 the operator will be required to acknowledge that they want to initiate the pump down control. The display will flash between “STArT P dN” and “PrESS EnTER”. Once the decision to continue is confirmed pump down logic will begin, and will take complete control of the unit until pump down either succeeds or fails. This operation can not be halted once it begins without power cycling the unit.</p> <p>After pump down logic has been initiated, the operator will be notified to close the Liquid Line Valve, the display will flash between “CLOSE LLV” and “PrESS EnTER”. Once complete the display will read “P dN” to the left, and the current suction pressure to the right. If the automatic pump down logic succeeds within 20 minutes, the unit will turn itself off, and the display will notify the operator that pump down is complete by flashing between “P dN DOnE” and “SHUT OFF”. The operator must then shut off the unit.</p> <p>If the automatic pump down logic does not complete within 20 minutes, the unit will drop out of Cd59 and return to its previous control condition.</p>
Cd60	Evaporator Fan Pulsing Temperature Setting	Cd60 contains a selectable temperature range used to determine the engagement point of the Evaporator Fan Pulsing logic. Default setting is -18.1°C. The user may change the temperature by pressing enter, then scrolling to the desired temperature using either arrow key. Press Enter to accept the change. The temperature setting will be retained until either a Pretrip or Trip Start is initiated at which time the temperature will set to the default setting.
Cd61	High Speed Evaporator Fan Setting	Cd61 is used to force evaporator fan speed to high while temperature control is being performed in the perishable setpoint range. When set to “On”, evaporator fans operate in high speed regardless of any other active option that can control evaporator fan speed. Following a power cycle, the state of the function select code is retained at its state prior to the power cycle. If “On”, this function select code will be set to “OFF” when any trip start occurs or any pretrip test is initiated. “----” will be displayed if setpoint is in frozen range or if CnF66 is configured OFF.

Figure 4.16 Alarm Troubleshooting Sequence



4.11 CONTROLLER ALARM INDICATIONS

AL03	LOSS OF SUPERHEAT CONTROL	
Cause:	Superheat has remained below 1.66°C (3°F) degrees for five minutes continuously while compressor running. Compressor drawing more than 2.0 amps, compressor pressure ratio is greater than 1.8, and Electronic Expansion Valve (EEV) is at 0% open.	
	Component	Electronic Expansion Valve (EEV)
	Troubleshooting	Check the operation of the EEV using Cd41.
	Corrective Action	Replace EEV if defective.
	Component	Evaporator Temperature Sensor(s) ETS & ETS1.
	Troubleshooting	Verify accuracy of temperature sensors, refer to Sensor Checkout Procedure Section 7.24 .
	Corrective Action	Replace ETS or ETS1 if defective.
	Component	Evaporator Fans
	Troubleshooting	Confirm fans operating properly
	Corrective Action	Replace fan(s) if defective, refer to EVAPORATOR FAN MOTOR ASSEMBLY Section 7.14 .

AL05	MANUAL DEFROST SWITCH FAILURE	
Cause:	Controller has detected continuous Manual Defrost Switch activity for five minutes or more.	
	Component	Keypad
	Troubleshooting	Power cycle the unit.
	Corrective Action	Resetting the unit may correct problem, monitor the unit. If the alarm reappears after 5 minutes replace the keypad.

AL06	KEYPAD OR KEYPAD HARNESS FAIL	
Cause:	Controller has detected one of the keypad keys is continuously active.	
	Component	Keypad or Harness
	Troubleshooting	Power cycle the unit.
	Corrective Action	Resetting the unit may correct problem, monitor the unit. If the alarm reappears replace the keypad and harness.

AL07	FRESH AIR VENT OPEN WITH FROZEN SET POINT	
Cause:	The VPS is reading greater than 0 CMH while unit is in frozen mode.	
	Component	Vent Position Sensor (VPS)
	Troubleshooting	Manually reposition vent and confirm using Cd45. Refer to VENT POSITION SENSOR SERVICE Section 7.25 .

AL07	FRESH AIR VENT OPEN WITH FROZEN SET POINT	
	Corrective Action If unable to obtain zero reading, replace defective VPS.	

AL08	HIGH COMPRESSOR PRESSURE RATIO	
Cause:	Controller detects discharge pressure to suction pressure ratio is too high. The controller will attempt to correct the situation by restarting the compressor.	
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 .
	Corrective Action	Replace DPT if defective.

AL10	CO2 SENSOR FAILURE	
Cause:	Alarm 10 is triggered when the CO ₂ sensor voltage is operating outside of the 0.9 v to 4.7 v range, or if the sensor is out of range.	
	Component	This is a display alarm and has no associated failure action.
	Troubleshooting	Refer to eAutoFresh manual.
	Corrective Action	The alarm is triggered off when voltage is within operating range.

AL14	PHASE SEQUENCE DETECT FAULT	
Cause:	Controller is unable to determine the correct phase relationship.	
	Component	N/A
	Troubleshooting	Power cycle the unit..
	Corrective Action	Resetting the unit may correct problem, monitor the unit.
	Component	Wiring
	Troubleshooting	Check unit wiring. Confirm pressure readings during start-up; suction pressure should decrease and discharge pressure should increase.
	Corrective Action	Correct wiring.
	Component	Current Sensor
	Troubleshooting	Check Cd41, right most digit: If display is 3 or 4 check compressor / sensor wiring. If display is 5 the current sensor is defective.
	Corrective Action	Replace current sensor if defective.

AL16	COMPRESSOR CURRENT HIGH	
Cause:	Compressor current draw is over the calculated maximum for 10 minutes.	
	Component	Current Sensor

AL16	COMPRESSOR CURRENT HIGH	
	Troubleshooting	Compare Cd3 to actual measured current at wire T1-T2 or T3 going to the compressor contactor. If there is a difference, determine whether this is caused by current sensor or amp clamp tool.
	Corrective Action	Replace current sensor if defective.
	Component	Amperage is indeed too high.
	Troubleshooting	Confirm supply voltage/frequency is within specification and balanced according to Electrical Data Section 3.3 .
	Corrective Action	Correct power supply.
	Component	Operating Conditions
	Troubleshooting	Make sure system pressures are relevant to operating conditions.
	Corrective Action	Check air flow of condenser. Check Refrigerant charge, refer to REFRIGERATION SYSTEM SERVICE Section 7.3 .
	Component	Monitor Unit
	Troubleshooting	Alarm is display only the alarm may clear itself during operation.
	Corrective Action	If alarm remains active or is repetitive replace compressor at next available opportunity, refer to COMPRESSOR Service Section 7.8 .

AL17	COMPRESSOR PRESSURE DELTA FAULT	
Cause:	Compressor has attempted to start in both directions and fails to generate sufficient pressure differential between SPT and DPT.	
	Component	N/A
	Troubleshooting	Controller will attempt restart every 20 minutes and deactivate the alarm if successful.
	Corrective Action	Resume normal operation.
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 .
	Corrective Action	Replace DPT if defective.
	Component	Suction Pressure Transducer (SPT)
	Troubleshooting	Confirm accurate SPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 .
	Corrective Action	Replace SPT if defective.
	Component	Monitor Unit
	Troubleshooting	Alarm is display only the alarm may clear itself during operation.
	Corrective Action	If alarm remains active or is repetitive replace compressor at next available opportunity.

AL18	DISCHARGE PRESSURE HIGH	
Cause:	Discharge pressure is over the maximum for 10 minutes within the last hour.	
	Component	Restrictions in the refrigeration system.
	Troubleshooting	Ensure Liquid Line Service Valve is fully open.
	Corrective Action	Open Liquid Line Service Valve as needed.
	Component	Filter Drier
	Troubleshooting	Check the filter drier, if it is iced up or very cold it indicates that the filter drier needs replacement.
	Corrective Action	Replace the filter drier if needed, refer to FILTER DRIER Service Section 7.12 .
	Component	Condenser Fan
	Troubleshooting	Check Condenser Fan for proper operation.
	Corrective Action	Correct as required.
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 .
	Corrective Action	Replace DPT if defective.
	Component	Non-condensables in the refrigeration system.
	Troubleshooting	With the unit off allow system to stabilize to ambient temperature. Check system pressure against PT Chart for 134a, refer to Table 7-4 .
	Corrective Action	Correct as required, refer to Refrigerant Charge Section 7.7.1 .
	Component	Refrigerant
	Troubleshooting	Check refrigerant level.
	Corrective Action	Correct as required, refer to Refrigerant Charge Section 7.7.1 .

AL19	DISCHARGE TEMPERATURE HIGH	
Cause:	Discharge temperature exceeds 135°C (275°F) for 10 minutes within the last hour.	
	Component	Restrictions in the refrigeration system.
	Troubleshooting	Ensure the Discharge Service Valve is fully open.
	Corrective Action	Open the Discharge Service Valve as needed.
	Troubleshooting	Check the unit for air flow restrictions.
	Corrective Action	Clean or remove any debris from coils.
	Component	Non-condensables in the refrigeration system.
	Troubleshooting	With the unit off allow system to stabilize to ambient temperature. Check system pressure against PT Chart for 134a, refer to Table 7-4 .
	Corrective Action	Correct as required, refer to Refrigerant Charge Section 7.7.1 .
	Component	Additional Alarms such as AL16, AL24.

AL19	DISCHARGE TEMPERATURE HIGH	
	Troubleshooting	Check compressor operation.
	Corrective Action	If the alarm persists, it may indicate a failing compressor, replace the compressor, refer to COMPRESSOR Service Section 7.8 .

AL20	CONTROL CONTACTOR FUSE (F3)	
Cause:	Control power fuse (F3A or F3B) is open.	
	Component	Check F3A, if the fuse is open:
	Troubleshooting	Check PA, PB, CH coils for short to ground, if short is found:
	Corrective Action	Replace the defective coil. Replace the fuse.
	Component	Check F3B, if the fuse is open:
	Troubleshooting	Check ESV coil resistance at TP7 to TP9, if short to ground, or if resistance is less than 4 ohms, coil is defective. Check CF, ES, EF, HR coils for short to ground, if short is found, coil is defective.
	Corrective Action	Replace the defective coil. Replace the fuse.
	Component	Check Voltage at QC1:
	Troubleshooting	If voltage is present, it indicates a defective microprocessor.
	Corrective Action	Refer to Controller Service Section 7.23 .

AL21	CONTROL CIRCUIT FUSE (F1/F2)	
Cause:	One of the 18 VAC controller fuses (F1/F2) is open. Refer to Cd08.	
	Component	System Sensors
	Troubleshooting	Check system sensors for short to ground.
	Corrective Action	Replace defective sensor(s).
	Component	Wiring
	Troubleshooting	Check wiring for short to ground.
	Corrective Action	Repair as needed.
	Component	Controller
	Troubleshooting	Controller may have an internal short.
	Corrective Action	Replace controller, refer to Controller Service Section 7.23 .

AL22	EVAPORATOR IP	
Cause:	Evaporator motor internal protector (IP) is open.	
	Component	Evaporator Motor

AL22	EVAPORATOR IP	
	Troubleshooting	Shut down unit, disconnect power, & check Evaporator Motor IP at plug connection pins 4 & 6.
	Corrective Action	Replace defective evaporator fan motor, refer to EVAPORATOR FAN MOTOR Service Section 7.14 .

AL23	LOSS OF PHASE B	
Cause:	Controller fails to detect current draw.	
	Component	Incoming Power
	Troubleshooting	Check incoming power source.
	Corrective Action	Correct power source as required.

AL24	COMPRESSOR IP	
Cause:	Compressor internal protector (IP) is open.	
	Component	Compressor
	Troubleshooting	Shut down unit disconnect power, & check resistance of compressor windings at contactor T1-T2, T2-T3.
	Corrective Action	Monitor unit, if alarm remains active or is repetitive replace the compressor at the next available opportunity, refer to COMPRESSOR Service Section 7.8 .

AL25	CONDENSER IP	
Cause:	Condenser fan motor internal protector (IP) is open.	
	Component	Insufficient Air Flow
	Troubleshooting	Shut down unit and check condenser fan for obstructions.
	Corrective Action	Remove obstructions.
	Component	Condenser Fan Motor
	Troubleshooting	Shut down unit, disconnect power, & check Condenser Fan Motor IP at plug connection pins 1 & 2.
	Corrective Action	Replace defective condenser fan motor, refer to Condenser Fan Motor Assembly Service Section 7.11 .

AL26	ALL SENSORS FAILURE: SUPPLY/RETURN PROBES	
Cause:	Sensors out of range.	
	Component	All sensors detected as out of range
	Troubleshooting	Perform Pre-trip P5:
	Corrective Action	If P5 passes, no further action is required.

AL26	ALL SENSORS FAILURE: SUPPLY/RETURN PROBES	
	Corrective Action	If P5 fails, replace the defective sensor as determined by P5, refer to TEMPERATURE SENSOR Service Section 7.24 .

AL27	ANALOG TO DIGITAL ACCURACY FAILURE	
Cause:	Controller AD converter faulty.	
	Component	Controller
	Troubleshooting	Power cycle the unit. If the alarm persists, it indicates a defective microprocessor.
	Corrective Action	Replace defective microprocessor, refer to Controller Service Section 7.23 .

AL28	LOW SUCTION PRESSURE	
Cause:	Suction pressure too low for normal operation.	
	Component	N/A
	Troubleshooting	Power cycle the unit.
	Corrective Action	Resetting the unit may correct problem, monitor the unit.
	Component	Suction Pressure Transducer (SPT)
	Troubleshooting	Confirm accurate SPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 .
	Corrective Action	Replace SPT if defective.
	Component	Discharge Pressure Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 .
	Corrective Action	Replace DPT if defective.

AL29	AUTOFRESH FAILURE	
Cause:	Alarm 29 is triggered if CO ₂ or O ₂ level is outside of the limit range and the vent position is at 100% for longer than 90 minutes.	
	Component	Alarm LED will be activated and user intervention is required.
	Troubleshooting	Refer to eAutoFresh manual.
	Corrective Action	The alarm is triggered off when atmospheric conditions are within limit settings.

AL50	AIR VENT POSITION SENSOR (VPS)	
Cause:	VPS Sensor out of range.	
	Component	Vent Position Sensor (VPS)
	Troubleshooting	Make sure VPS is secure.

AL50	AIR VENT POSITION SENSOR (VPS)	
	Corrective Action	Manually tighten panel.
	Troubleshooting	If the alarm persists, replace the sensor or the assembly.
	Corrective Action	Replace VPS.

AL51	EEPROM FAILURE	
Cause:	Controller Memory Failure	
	Component	Controller
	Troubleshooting	Pressing the ENTER key when "CLEAR" is displayed will result in an attempt to clear the alarm.
	Corrective Action	If action is successful (all alarms are inactive), alarm 51 will be reset.
	Troubleshooting	Power cycle the unit. If the alarm persists, it indicates defective controller memory.
	Corrective Action	Replace defective controller, refer to Controller Service Section 7.23 .

AL52	EEPROM ALARM LIST FULL	
Cause:	Alarm list queue is full	
	Component	Active Alarms
	Troubleshooting	Repair any alarms in the queue that are active. Indicated by "AA".
	Corrective Action	Clear alarms, refer to CONTROLLER ALARMS Section 4.6 .

AL53	BATTERY PACK FAILURE	
Cause:	Battery voltage low	
	Component	Battery
	Troubleshooting	If this alarm occurs on start up, allow a unit fitted with rechargeable batteries to operate for up to 24 hours to charge rechargeable batteries sufficiently. Once fully charged, the alarm will deactivate.
	Corrective Action	To clear the alarm press ENTER and ALT simultaneously at the startup of Cd19 (Battery Check). If alarm persists, replace the battery pack, refer to Section 7.23.5 Battery Replacement.

AL54	PRIMARY SUPPLY SENSOR (STS)	
Cause:	Invalid Supply Temperature Sensor (STS) reading.	
	Component	Supply Temperature Sensor (STS)
	Troubleshooting	Perform Pre-trip P5:
	Corrective Action	If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5, refer to TEMPERATURE SENSOR Service Section 7.24 .

AL56	PRIMARY RETURN SENSOR (RTS)	
Cause:	Invalid Return Temperature Sensor (RTS) reading.	
	Component	Return Temperature Sensor (RTS)
	Troubleshooting	Perform Pre-trip P5:
	Corrective Action	If P5 passes, no further action is required. If P5 fails, replace the defective sensor as determined by P5, refer to TEMPERATURE SENSOR Service Section 7.24 .

AL57	AMBIENT SENSOR (AMBS)	
Cause:	Invalid Ambient Temperature Sensor (AMBS) reading.	
	Component	Ambient Temperature Sensor (AMBS)
	Troubleshooting	Test the AMBS, refer to Sensor Checkout Procedure Section 7.24.1 .
	Corrective Action	Replace AMBS if defective, refer to TEMPERATURE SENSOR Service Section 7.24 .

AL58	COMPRESSOR HIGH PRESSURE SAFETY (HPS)	
Cause:	High pressure safety switch remains open for at least one minute.	
	Component	High Pressure Switch (HPS)
	Troubleshooting	Test the HPS; refer to Checking High Pressure Switch, Section 7.9.1 .
	Corrective Action	Replace HPS if defective, refer to Sensor Replacement, Section 7.24 .
	Component	Refrigeration System
	Troubleshooting	Check unit for air flow restrictions.
	Corrective Action	Clean or remove any debris from coils.

AL59	HEATER TERMINATION THERMOSTAT (HTT)	
Cause:	Heat Termination Thermostat (HTT) is open.	
	Component	Heat Termination Thermostat (HTT)
	Troubleshooting	Check for 24 volts at test point TP10, if no voltage at TP10 after unit has reached set point HTT is open.
	Corrective Action	Replace HTT if defective, refer to Sensor Replacement Section 7.24 .

AL60	DEFROST TEMPERATURE SENSOR (DTS)	
Cause:	Failure of the Defrost Temperature Sensor (DTS) to open.	
	Component	Defrost Temperature Sensor (DTS)
	Troubleshooting	Test the DTS; refer to Sensor Checkout Procedure Section 7.24.1 .

AL60	DEFROST TEMPERATURE SENSOR (DTS)	
	Corrective Action	Replace the DTS if defective, refer to Sensor Replacement Section 7.24.

AL61	HEATER CURRENT DRAW FAULT	
Cause:	Improper current draw during heat or defrost mode.	
	Component	Heater(s)
	Troubleshooting	While in heat or defrost mode, check for proper current draw at heater contactors, refer to ELECTRICAL DATA Section 3.3.
	Corrective Action	Replace heater(s) if defective, refer to Section 7.13.2 Evaporator Heater Removal and Replacement.
	Component	Contactor
	Troubleshooting	Check voltage at heater contactor on the heater side. If no voltage present:
	Corrective Action	Replace heater contactor if defective.

AL63	CURRENT LIMIT	
Cause:	Unit operating above current limit.	
	Component	Refrigeration System
	Troubleshooting	Check unit for air flow restrictions.
	Corrective Action	Clean or remove any debris from coils.
	Troubleshooting	Check unit for proper operation.
	Corrective Action	Repair as needed.
	Component	Power supply
	Troubleshooting	Confirm supply voltage/frequency is within specification and balanced according to ELECTRICAL DATA Section 3.3.
	Corrective Action	Correct power supply.
	Component	Current limit set too low
	Troubleshooting	Check current limit setting Code Cd32.
	Corrective Action	The current limit can be raised (maximum of 23 amps) using Cd32.

AL64	DISCHARGE TEMPERATURE SENSOR (CPDS)	
Cause:	Discharge Temperature sensor out of range.	
	Component	Discharge temperature sensor (CPDS).
	Troubleshooting	Test the CPDS; refer to Sensor Checkout Procedure, Section 7.24.1.
	Corrective Action	Replace the CPDS if defective, refer to Sensor Replacement Section 7.24.

AL65	DISCHARGE PRESSURE TRANSDUCER (DPT)	
Cause:	Compressor Discharge Transducer is out of range.	
	Component	Compressor Discharge Transducer (DPT)
	Troubleshooting	Confirm accurate DPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 . <i>- Performing a Pre-trip 5-9 test will also check the transducers.</i>
	Corrective Action	Replace DPT if defective.

AL66	(SPT) SUCTION PRESSURE TRANSDUCER, (EPT) EVAPORATOR PRESSURE TRANSDUCER	
Cause:	Suction Pressure Transducer (SPT) out of range.	
	Component	Suction Pressure Transducer (SPT)
	Troubleshooting	Confirm accurate EPT and SPT pressure readings, refer to MANIFOLD GAUGE SET Section 7.2 . <i>- Performing a Pre-trip 5-9 test will also check the transducers.</i>
	Corrective Action	Replace EPT/SPT if defective.
	Troubleshooting	Monitor
	Corrective Action	If the alarm persists, it may indicate a failing compressor, refer to COMPRESSOR Service Section 7.8 .

AL67	HUMIDITY SENSOR	
Cause:	Humidity Sensor (HS) reading out of range.	
	Component	Humidity Sensor (HS)
	Troubleshooting	Make sure the humidity sensor is properly connected in the socket. Make sure the humidity sensor wires have not been damaged.
	Corrective Action	Monitor, replace HS if alarm persists.

AL69	EVAPORATOR TEMP SENSOR (ETS1)	
Cause:	Evaporator Temperature Sensor (ETS1) out of range.	
	Component	Evaporator Temperature Sensor (ETS1)
	Troubleshooting	Test the ETS1, refer to Sensor Checkout Procedure Section 7.13.2 .
	Corrective Action	Replace Evaporator Temperature Sensor (ETS1) if defective.

AL70	SECONDARY SUPPLY SENSOR (SRS)	
Cause:	Secondary Supply Sensor (SRS) is out of range.	
	Component	Secondary Supply Sensor (SRS)
	Troubleshooting	Perform Pre-trip P5:

AL70	SECONDARY SUPPLY SENSOR (SRS)	
	Corrective Action	If P5 passes, no further action is required.
	Corrective Action	If P5 fails, replace the defective sensor as determined by P5, refer to TEMPERATURE SENSOR Service Section 7.24 .

AL71	SECONDARY RETURN SENSOR (RRS)	
Cause:	Secondary Return Sensor (RRS) is out of range.	
	Component	Secondary Retrn Sensor (RRS)
	Troubleshooting	Perform Pre-trip P5:
	Corrective Action	If P5 passes, no further action is required.
	Corrective Action	If P5 fails, replace the defective sensor as determined by P5, refer to TEMPERATURE SENSOR Service Section 7.24 .

AL72	CONTROL TEMP OUT OF RANGE	
Cause:	After the unit goes in-range for 30 minutes then out of range for a continuous 120 minutes.	
	Component	Refrigeration System
	Troubleshooting	Ensure unit is operating correctly.
	Corrective Action	Power cycle unit. Control Temperature is in In-range. Any Pre-trip mode, resets the timers.

NOTICE

If the controller is configured for four probes without a DataCORDER, the DataCORDER alarms AL70 and AL71 will be processed as Controller alarms AL70 and AL71. Refer to [Table 4-9](#).

ERR#	INTERNAL MICROPROCESSOR FAILURE	
Cause:	Internal Microprocessor Failure The controller performs self-check routines. If an internal failure occurs, an "ERR" alarm will appear on the display. This is an indication the controller needs to be replaced.	
	Error	Description
	ERR 0-RAM failure	Indicates that the controller working memory has failed.
	ERR 1-Program Memory Failure	Indicates a problem with the controller program.
	ERR 2-Watchdog time-out	The controller program has entered a mode whereby the controller program has stopped executing.
	ERR 3-N/A	N/A
	ERR 4-N/A	N/A
	ERR 5-A-D failure	The controller's Analog to Digital (A-D) converter has failed.
	ERR 6-IO Board failure	Internal program/update failure.
	ERR 7-Controller failure	Internal version/firmware incompatible.

ERR#	INTERNAL MICROPROCESSOR FAILURE	
	ERR 8-DataCORDER failure	Internal DataCORDER memory failure.
	ERR 9-Controller failure	Internal controller memory failure.
<p>In the event that a failure occurs and the display cannot be updated, the status LED will indicate the appropriate ERR code using Morse code as shown below.</p> <p>E R R 0 to 9 ERR0 = ERR1 = ERR2 = ERR3 = ERR4 = ERR5 = ERR6 = ERR7 = ERR8 = ERR9 =</p>		

ENTR STPT	ENTER SET POINT (PRESS ARROW & ENTER)
Cause:	The controller is prompting the operator to enter a set point.

LO	LOW MAIN VOLTAGE (FUNCTION CODES CD27-38 DISABLED AND NO ALARM STORED.)
Cause:	This message will be alternately displayed with the set point whenever the supply voltage is less than 75% of its proper value.

4.12 CONTROLLER PRE-TRIP TEST CODES

Table 4–6 Controller Pre-trip Test Codes

NOTE “Auto” or “Auto1” menu includes the: P0, P1, P2, P3, P4, P5, P6 and rSLts. “Auto2” menu includes P0, P1, P2, P3, P4, P5, P6, P7, P8, P9, P10 and rSLts. “Auto3” menu includes P0, P1, P2, P3, P4, P5, P6, P7 and P8.		
P0-0 Pre-Trip Initiated: Configuration Display, Indicator Lamps, LEDs, and Displays		
		Container identifier code, Cd18 Software Revision Number, Cd20 Container Unit Model Number, & configuration database identifier CFM-MYYDD are displayed in sequence. Next the unit will indicate the presence or non-presence of an RMU according to whether any RMU inquiry messages have been received since the unit was booted. Units equipped with Autoslide Enabled (Cnf44) will cause the vent to seek to its closed position, followed by two sequences of opening to 100% and returning to the closed position. No other autoslide mode of operation will be available until the two cycles of opening and closing have completed. Since the system cannot recognize lights and display failures, there are no test codes or results associated with this phase of Pretrip. To know if the test passes the operator must observe that the LCD display elements and the indicator lights behave as described below.
P1 Tests - Heaters Current Draw: Heater is turned on, then off. Current draw must fall within specified range. No other system components will change state during this test.		
P1-0	Heaters Turned On	Heater starts in the off condition, current draw is measured, and then the heater is turned on. After 15 seconds, the current draw is measured again. The change in current draw is then recorded. Test passes if the change in current draw test is in the range specified.
P1-1	Heaters Turned Off	Heater starts in the off condition, current draw is measured, and then the heater is turned on. After 15 seconds, the current draw is measured again. The change in current draw is then recorded. Test passes if the change in current draw test is in the range specified.
P2 Tests - Condenser Fan Current Draw: Condenser fan is turned on, then off. Current draw must fall within specified range. No other system components will change state during this test. If the Water Pressure Switch is open this test will be skipped.		
P2-0	Condenser Fan On	Condenser fan starts in the off condition, current draw is measured, and condenser fan is then turned on. After 15 seconds the current draw is measured again. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P2-1	Condenser Fan Off	Condenser fan is then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P3 Tests - Low Speed Evaporator Fan Current Draw: The system must be equipped with a low speed evaporator fan, as determined by CnF02, the Evaporator Fan Speed Select configuration variable. Low speed evaporator fan is turned on, then off. Current draw must fall within specified range. No other system components will change state during this test.		
NOTE If unit configured for single evaporator fan operation and either AL11 or AL12 is active at the start of either test, then the test will fail immediately. If AL11 or AL12 become active during the test, then the test will fail upon conclusion of the test.		
P3-0	Low Speed Evaporator Fan Motors On	High speed evaporator fans will be turned on for 20 seconds, the fans will be turned off for 4 seconds, current draw is measured, and then the low speed evaporator fans are turned on. After 60 seconds the current draw is measured again. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.

Table 4–6 Controller Pre-trip Test Codes

P3-1	Low Speed Evaporator Fan Motors Off	Low speed evaporator fans are then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P4 Tests - High Speed Evaporator Fans Current Draw: High speed evaporator fans are turned on, then off. Current draw must fall within specified range and measured current changes must exceed specified ratios. No other system components will change state during this test.		
		NOTE
		If unit configured for single evaporator fan operation and either AL11 or AL12 is active at the start of either test, then the test will fail immediately. If AL11 or AL12 become active during the test, then the test will fail upon conclusion of the test.
P4-0	High Speed Evaporator Fan Motors On	Evaporator fans start in the off condition, current draw is measured, then high speed evaporator fans will be turned on. After 60 seconds the current draw is measured again. The change in current draw is then recorded. Test passes if change in current draw in the specified range AND measured current changes exceed specified ratios. If the three phase motors are configured IN, the change ratio test is skipped.
P4-1	High Speed Evaporator Fan Motors Off	High speed evaporator fans are then turned off. After 10 seconds the current draw is measured. The change in current draw is then recorded. Test passes if change in current draw test is in the specified range.
P5 Tests - Air Stream Temperature Sensor Tests: Tests the validity of the Air Stream Temperature Sensors.		
P5-0	Supply/Return Probe Test	The High Speed Evaporator Fan is turned on and run for eight minutes, with all other outputs de-energized. A temperature comparison is made between the return and supply probes. Test passes if temperature comparison falls within the specified range. NOTE If this test fails, "P5-0" and "FAIL" will be displayed. If both Probe tests (this test and the PRIMARY/SECONDARY) pass, display will read "P5" "PASS."
P5-1	Supply Probe Test	This test is for units equipped with secondary supply probe only. The temperature difference between primary supply probe and secondary supply probe is compared. Test passes if temperature comparison falls within the specified range. NOTE If this test fails, "P5-1" and "FAIL" will be displayed. If both Probe tests (this and the SUPPLY/RETURN TEST) pass, because of the multiple tests, the display will read "P5" "PASS."
P5-2	Return Probe Test	For units equipped with secondary return probe only. The temperature difference between return temperature sensor (RTS) and return temperature sensor (RRS) probe is compared. Test passes if temperature comparison falls within the specified range. NOTES 1. If this test fails, "P5-2" and "FAIL" will be displayed. If both Probe tests (this test and the SUPPLY/RETURN) pass, because of the multiple tests, the display will read "P 5," "PASS." 2. The results of Pre-trip tests 5-0, 5-1 and 5-2 will be used to activate or clear control probe alarms.

Table 4–6 Controller Pre-trip Test Codes

P5-3	Evaporator Fan Direction Test	With evaporator fan running on high speed, measure the temperature difference between the primary supply and primary return probes. Turn the heaters on for 60 seconds then measure the temperature difference between the primary supply and primary return probes for up to 120 additional seconds. This is a Pass/Fail test. The test passes if differential of STS is 0.25°C higher than RTS. Test P5-0 must pass before this test is run.
P5-7	Primary vs. Secondary Evaporator Temperature Sensor Test	This is a Pass/Fail test of the primary evaporator temperature sensor (ETS1) and secondary evaporator temperature sensor (ETS2). Test passes if secondary evaporator temperature sensor (ETS2) is within +/- 0.5°C of the primary evaporator temperature sensor (ETS1).
P5-8	Primary Evaporator Pressure Transducer Test	This is a Pass/Fail test of the Primary Evaporator Pressure Transducer. Test passes if suction pressure transducer (SPT) is within +/- 0 psi of saturation pressure at current evaporator temperature. Also passes if SPT is within +/- 1 psi of discharge pressure 6 hours after a power interruption. Test P5-7 must pass before this test is run.
P5-9	Suction (Evaporator) Pressure Transducer Test	Units equipped with a secondary Evaporator pressure transducer. Test passes if suction pressure transducer (SPT) is within +/- 1.5 psi of the evaporator pressure transducer (EPT). Test P5-8 must pass before this test is run.
P5-10	Humidity Sensor Controller Configuration Verification Test	This is a Pass/Fail/Skip test of the humidity sensor configuration. Test passes if the controller configuration has humidity sensor in. Test fails if the controller configuration has humidity sensor out and Vout is greater than 0.20 Volts for the humidity sensor. Test is skipped if the controller configuration has the humidity sensor out and Vout is less than 0.20 Volts. Test P5-9 must pass before this test is run.
P5-11	Humidity Sensor Installation Verification Test	This is a Pass/Fail test of humidity sensor installation (sensor is present). Test passes if Vout is greater than 0.20 Volts for the humidity sensor. Test fails if Vout is less than 0.20 Volts for the humidity sensor. Test P5-10 must pass before this test is run.
P5-12	Humidity Sensor Range Check Test	This is a Pass/Fail test of the Humidity Sensor Range. Test passes if Vout for the humidity sensor is between 0.33 Volts and 4 Volts. Test fails if Vout is outside of this range. Test P5-11 must pass before this test is run.
P6 Tests - Refrigerant Probes, Compressor and Refrigerant Valves: Pass/Fail testing is performed for the compressor, EEV, DUV, LIV (if equipped), ESV, and the refrigerant pressure and temperature sensors.		
P6-0	Discharge Thermistor Test	If Alarm 64 is active the test fails. Otherwise, the test passes.
P6-1	Suction Thermistor Test	If the Suction Temperature Sensor (CPSS) both is configured ON and is invalid, the test fails. Otherwise the test passes.
P6-2	Discharge Pressure Transducer Test	If Alarm 65 is active any time during the first 45 second period, the test fails. Otherwise, the test passes.
P6-3	Suction Pressure Transducer Test	If Alarm 66 is active the test fails. Otherwise the test passes.
P6-4	Compressor Current Draw Test	Compressor current is tested before and 10 seconds after start up. If current does not increase, the test fails. P6-7 is run at the end of P6-4. If this test fails, P6-6 is skipped.

Table 4–6 Controller Pre-trip Test Codes

P6-5	Compressor Leak Test	Pre-trip P6-5 ensures that the compressor holds pressure. After compressor pump up and pump down, the compressor is turned off for 62 seconds. When suction side pressure holds (less than 8 psi rise) for 10 seconds, P6-5 passes, otherwise the Compressor Leak Test fails.
NOTE		
P6-6 through P6-10 are conducted by changing status of each valve and comparing suction pressure change and/or compressor current change with predetermined values. Tests will cause compressor and condenser fans to cycle on and off as needed to generate the pressure required for individual Pre-trip sub tests. The compressor will start in order to build discharge pressure, followed by compressor pump down sequence. At the conclusion of compressor pump down sequence, the compressor will shut down and the valve test will start.		
P6-6	Economizer Valve Test	Passes if suction pressure increases a minimum of 4 psia when the valve opens for 15 seconds.
P6-7	Digital Unloader Valve Test	Passes if pressure and current changes are within 3 seconds of DUV switch signal and either the pressure change or the current draw change is above 5 psi or above 1.5A, respectively.
P6-9	Liquid Injection Valve Test	(If equipped) Test passes if change of suction pressure is greater than 4 psia when the valve opens for 10 seconds. Otherwise, it fails.
P6-10	Electronic Expansion Valve Test	The test records the suction pressure during the open valve position and passes if the suction pressure increase is above 3 psi when the valve opens for 10 seconds.
NOTE		
P7-0 & P8 are included with “Auto 2 & Auto 3” only. P9-0 through P10 are included with “Auto2” only.		
P7 Tests - High Pressure Tests: Unit is run at full capacity without condenser fan running to make sure that the HPS opens and closes properly.		
P7-0	High Pressure Switch (HPS) Opening Test	<p>Test is skipped if sensed ambient temperature is less than 7.2°C (45°F), return air temperature is less than -17.8°C (0°F), or the water pressure switch is open.</p> <p>With the unit running, the condenser fan is turned off and a 900 second (15 minute) timer is started. The right display shows Discharge Pressure if the sensor is configured and valid, else Discharge Temperature. The unit needs to disable Discharge Pressure limit and enable Current Limit checks.</p> <p>The test fails immediately if:</p> <ul style="list-style-type: none"> -Ambient Temperature Sensor invalid -Composite Return Temperature Sensor invalid -HPS is open <p>The test fails if:</p> <ul style="list-style-type: none"> -HPS fails to open before 900 seconds total test time. -Evaporator or Compressor IP Alarm. -Calculated Dome Temperature exceeds 137.78°C (280°F). -Discharge pressure exceeds 370 psig. -Compressor Current exceeds limits <p>The test passes if HPS opens within the 15 minute time limit.</p>
P7-1	High Pressure Switch (HPS) Closing Test	<p>If return temperature greater than -2.4°C, set setpoint to -5.0°C, else set setpoint to -30°C. Restart unit according to normal startup logic. Run unit normally for 120 seconds.</p> <p>The test passes if the high pressure switch closes within 75 seconds after end of Test 7-0, else the test fails.</p> <p>Test P7-0 must pass for this test to execute.</p>
P8 Tests - Perishable Mode Tests: Pretrip tests P7-0 and P7-1 must have passed or have been skipped for these tests to execute.		

Table 4–6 Controller Pre-trip Test Codes

P8-0	Perishable Mode Test	If the control temperature is below 15.6°C, the setpoint is changed to 15.6°C, and a 180 Minute timer is started. The control will then be placed in the equivalent of normal heating. If the control temperature is above 15.6°C. at the start of the test, then the test proceeds immediately to test 8-1. While in test 8-0 the right display will show the value of the control temperature. The test fails if the 180 Minute timer expires before the control temperature reaches setpoint - 0.3°C. If the test fails, it will not auto-repeat. There is no pass display for this test. Once the control temperature reaches setpoint, the test proceeds to test 8-1.
P8-1	Perishable Mode Pull Down Test / eAutofresh CO ₂ Sensor Calibration	Control temperature must be at least 15.6°C (60°F). The set point is changed to 0°C (32°F), and a 180-minute timer is started. The left display will read "P8-1," the right display will show the supply air temperature. The unit will then start to pull down the temperature to the 0°C set point. The test passes if the container temperature reaches set point before the 180-minute timer expires. On units where the CO ₂ Sensor Status indicates that a CO ₂ sensor is present, calibration of the CO ₂ sensor will be attempted during P8-1. Once P8-1 begins, calibration will be attempted when the supply temperature goes below 5°C. If the CO ₂ sensor voltage reads within the 0.95 <>1.15Vdc range before the end of P8-1, the sensor will be calibrated by holding the CO ₂ zero line low for 4 seconds. Once calibration is performed, the sensor voltage will be verified to make sure it is in the 0.95 to 1.05 Vdc range. If the voltage is not within this range, CO ₂ sensor calibration fails.
P8-2	Perishable Mode Maintain Temperature Test	Test P8-1 must pass for P8-2 to execute. A fifteen minute timer is started, and the system will attempt to minimize control temperature error (supply temperature minus setpoint) until the timer expires. The control temperature will be sampled each minute starting at the beginning of P8-2. During P8-2, the left display will read "P8-2," and the right display will show the supply air temperature. When the test is completed, the average control temperature error will be compared to the pass/fail criteria. Test passes if the average temperature error is within +/- 1.0°C. Test fails if the average temperature error is greater than +/- 1.0°C, or if the DataCORDER supply temperature probe is invalid. If the test fails, the control probe temperature will be recorded as -50.0°C.
P9 Test - DTT Close and Open Test: The DTT in this control is not a physical device, with actual metallic contacts, it is a software function that acts similar to a thermostat. Using various temperature inputs, the DTT function determines whether a thermostat mounted on the Evaporator Coil would have OPEN or CLOSED contacts. Primarily, the DTT function operates based on the temperature reading from the Defrost Termination Sensor.		

Table 4–6 Controller Pre-trip Test Codes

P9-0	DTT Closed and Open Test	<p>During P9-0 the defrost temperature sensor (DTS) reading will be displayed on the left display. The right display will show the supply air temperature.</p> <p>The unit will run FULL COOL for 30 minutes maximum until the DTT is considered closed. This step may not have to be executed. Once the DTT is considered closed, the unit simulates defrost by running the heaters for up to two hours, or until the DTT is considered open.</p> <p>Test fails if:</p> <ul style="list-style-type: none">The DTT is not considered closed after the 30 minutes of full cooling.HTT opens when DTT is considered closed or if return air temperature rises above 48°C (120°F). <p>Test passes if the DTT is considered open within the 2 hour heat cycle time limit.</p>
P10 Tests - Frozen Mode Tests:		
P10-0	Frozen Mode Heat Test	<p>If the container temperature is below 7.2°C, the setpoint is changed to 7.2°C, and a 180 Minute timer is started. The control will then be placed in the equivalent of normal heating. If the container temperature is above 7.2°C. at the start of the test, then the test proceeds immediately to test 10-1. During this test, the control temperature will be shown on the right display.</p> <p>The test fails if the 180 Minute timer expires before the control temperature reaches setpoint - 0.3°C. If the test fails, it will not auto-repeat. There is no pass display for this test. Once the control temperature reaches setpoint, the test proceeds to test 10-1.</p>
P10-1	Frozen Mode Pulldown Test	<p>Control temperature must be at least 7.2°C (45°F)</p> <p>The setpoint is changed to -17.8°C. The system will then attempt to pull down the control temperature to setpoint using normal frozen mode cooling. During this test, the control temperature will be shown on the right display.</p> <p>The test passes if the control temperature reaches setpoint minus 0.3°C before the 180 minute timer expires. Otherwise, the test fails. Upon failure and when initiated by an automatic Pre-trip sequence, P10-1 will auto-repeat once by starting P10-0 over again.</p>
P10-2	Frozen Mode Maintain Temperature Test	<p>Test P10-1 must pass for this test to execute.</p> <p>Same as for test 8-2 except the control temperature is the return probe temperature.</p> <p>The average error must be +/-1.6°C. If the DataCORDER supply temperature probe is invalid, the test fails and the control probe temperature will be recorded as -50°C. Upon failure and when initiated by an automatic Pre-trip sequence, P10-2 will auto-repeat by starting P10-0 over again.</p>

Table 4–7 DataCORDER Function Code Assignments

NOTE Inapplicable Functions Display “-----”		
To Access: Press ALT. MODE key then CODE SELECT key		
Code No.	TITLE	DESCRIPTION
dC1	Recorder Supply Temperature	Current reading of the supply recorder sensor.
dC2	Recorder Return Temperature	Current reading of the return recorder sensor.
dC3-5	USDA 1,2,3 Temperatures	Current readings of the three USDA probes.
dC6-13	Network Data Points 1-8	Current values of the network data points (as configured). Data point 1 (Code 6) is generally the humidity sensor and its value is obtained from the controller once every minute.
dC14	Cargo Probe 4 Temperature	Current reading of the cargo probe #4.
dC15-19	Future Expansion	These codes are for future expansion, and are not in use at this time.
dC20-24	Temperature Sensors 1-5 Calibration	Current calibration offset values for each of the five probes: supply, return, USDA #1, #2, and #3. These values are entered via the interrogation program.
dC25	Future Expansion	This code is for future expansion, and is not in use at this time.
dC26,27	S/N, Left 4, Right 4	The DataCORDER serial number consists of eight characters. Function code dC26 contains the first four characters. Function code dC27 contains the last four characters. (This serial number is the same as the controller serial number.)
dC28	Minimum Days Left	An approximation of the number of logging days remaining until the DataCORDER starts to overwrite the existing data.
dC29	Days Stored	Number of days of data that are currently stored in the DataCORDER.
dC30	Date of Last Trip start	The date when a Trip Start was initiated by the user. In addition, if the system goes without power for seven continuous days or longer, a trip start will automatically be generated on the next AC power up. Press and hold “ENTER” key for five seconds to initiate a “Trip Start.”
dC31	Battery Test Results	Shows the current status of the optional battery pack. PASS: Battery pack is fully charged. FAIL: Battery pack voltage is low.
dC32	Time: Hour, Minute	Current time on the real time clock (RTC) in the DataCORDER.
dC33	Date: Month, Day	Current date (month and day) on the RTC in the DataCORDER.
dC34	Date: Year	Current year on the RTC in the DataCORDER.
dC35	Cargo Probe 4 Calibration	Current calibration value for the Cargo Probe. This value is an input via the interrogation program.

Table 4–8 DataCORDER Pre-trip Result Records

Test No.	Title	Data
1-0	Heater On	Pass/Fail/Skip Result, Change in current for Phase A, B and C
1-1	Heater Off	Pass/Fail/Skip Result, Change in currents for Phase A, B and C
2-0	Condenser Fan On	Pass/Fail/Skip Result, Water pressure switch (WPS) - Open/Closed, Change in currents for Phase A, B and C
2-1	Condenser Fan Off	Pass/Fail/Skip Result, Change in currents for Phase A, B and C
3-0	Low Speed Evaporator Fan On	Pass/Fail/Skip Result, Change in currents for Phase A, B and C
3-1	Low Speed Evaporator Fan Off	Pass/Fail/Skip Result, Change in currents for Phase A, B and C
4-0	High Speed Evaporator Fan On	Pass/Fail/Skip Result, Change in currents for Phase A, B and C
4-1	High Speed Evaporator Fan Off	Pass/Fail/Skip Result, Change in currents for Phase A, B and C
5-0	Supply/Return Probe Test	Pass/Fail/Skip Result, STS, RTS, SRS and RRS
5-1	Secondary Supply Probe (SRS) Test	Pass/Fail/Skip
5-2	Secondary Return Probe (RRS) Test	Pass/Fail/Skip
6-0	Discharge Thermistor Test	Pass/Fail/Skip
6-1	Suction Thermistor Test	Pass/Fail/Skip
6-2	Discharge Pressure Transducer Test	Pass/Fail/Skip
6-3	Suction Pressure Transducer Test	Pass/Fail/Skip
6-4	Compressor Current Draw Test	Pass/Fail/Skip
6-5	Compressor Leak Test	Pass/Fail/Skip
6-6	Economizer Valve Test	Pass/Fail/Skip
6-7	Digital Unloader Valve Test	Pass/Fail/Skip
6-9	Liquid Injection Valve Test (If equipped)	Pass/Fail/Skip
6-10	Electronic Expansion Valve Test	Pass/Fail/Skip
7-0	High Pressure Switch Closed	Pass/Fail/Skip Result, AMBS, DPT or CPT (if equipped) Input values that component opens
7-1	High Pressure Switch Open	Pass/Fail/Skip Result, STS, DPT or CPT (if equipped) Input values that component closes
8-0	Perishable Mode Heat Test	Pass/Fail/Skip Result, STS, time it takes to heat to 16°C (60°F)
8-1	Perishable Mode Pulldown Test	Pass/Fail/Skip Result, STS, time it takes to pull down to 0°C (32°F)
8-2	Perishable Mode Maintain Test	Pass/Fail/Skip Result, Averaged DataCORDER supply temperature (SRS) over last recording interval.
9-0	Defrost Test	Pass/Fail/Skip Result, DTS reading at end of test, line voltage, line frequency, time in defrost.
10-0	Frozen Mode Heat Test	Pass/Fail/Skip Result, STS, time unit is in heat.
10-1	Frozen Mode Pulldown Test	Pass/Fail/Skip Result, STS, time to pull down unit to -17.8°C (0°F).
10-2	Frozen Mode Maintain Test	Pass/Fail/Skip Result, Averaged DataCORDER return temperature (RRS) over last recording interval.

Table 4–9 DataCORDER Alarm Indications

To Access: Press ALT. MODE key then ALARM LIST key		
Code No.	TITLE	DESCRIPTION
dAL70	Recorder Supply Temperature Out of Range	<p>The supply recorder sensor reading is outside of the range of -50°C to 70°C (-58°F to +158°F), or the probe check logic has determined there is a fault with this sensor.</p> <p>NOTE</p> <p>The P5 Pre-trip test must be run to inactivate the alarm.</p>
dAL71	Recorder Return Temperature Out of Range	<p>The return recorder sensor reading is outside of the range of -50°C to 70°C (-58°F to +158°F), or the probe check logic has determined there is a fault with this sensor.</p> <p>NOTE</p> <p>The P5 Pre-trip test must be run to inactivate the alarm.</p>
dAL72-74	USDA Temperatures 1, 2, 3 Out of Range	The USDA probe temperature reading is outside of -50°C to 70°C (-58°F to +158°F) range.
dAL75	Cargo Probe 4 Out of Range	The cargo probe temperature reading is outside of -50°C to 70°C (-58°F to +158°F) range.
dAL76, 77	Future Expansion	These alarms are for future expansion and are not in use at this time.
dAL78-85	Network Data Point 1 - 8 Out of Range	<p>The network data point is outside of its specified range. The DataCORDER is configured by default to record the supply and return recorder sensors. The DataCORDER may be configured to record up to eight additional network data points. An alarm number (AL78 to AL85) is assigned to each configured point. When an alarm occurs, the DataCORDER must be interrogated to identify the data point assigned. When a humidity sensor is installed, it is usually assigned to AL78.</p>
dAL86	RTC Battery Low	<p>The real time clock (RTC) backup battery is too low to adequately maintain the RTC reading.</p> <p>A real time clock failure is critical to the operation of the unit. If this alarm occurs, replace the RTC battery at the next available opportunity. After replacing the battery the following actions are required:</p> <ul style="list-style-type: none"> - Update the RTC setting - Update the unit's software configuration - Update the operational software - Update all user selectable function code settings (defrost, setpoint, etc)
dAL87	RTC Failure	An invalid time has been detected. Either the DataCORDER run time hour and minute have not changed at the start of the hour, or the real time clock (RTC) time has gained or lost more than 2 minutes in the hour. This situation may be corrected by cycling the power, setting the clock or meeting the above criteria for an hour.
dAL88	DataCORDER EEPROM Failure	A write of critical DataCORDER information to the EEPROM has failed.
dAL89	Flash Memory Error	An error has been detected in the process of writing daily data to the non-volatile FLASH memory.
dAL90	Future Expansion	This alarm is for future expansion, and is not in use at this time.
dAL91	Alarm List Full	The DataCORDER alarm queue is determined to be full (eight alarms).

SECTION 5

OPERATION

5.1 INSPECTION

WARNING

Beware of unannounced starting of the evaporator and condenser fans. The unit may cycle the fans and compress or unexpectedly as control requirements dictate.

- a. Check inside for the following:
 1. Check channels or "T" bar floor for cleanliness. Channels must be free of debris for proper air circulation.
 2. Check container panels, insulation and door seals for damage. Effect permanent or temporary repairs.
 3. Visually check evaporator fan motor mounting bolts for proper securement (refer to [Section 7.14](#)).
 4. Check for visible corrosion on the evaporator stator and fan deck (refer to [Section 7.15](#)).
 5. Check for dirt or grease on evaporator fans or fan deck and clean if necessary.
 6. Check evaporator coil for cleanliness or obstructions. Wash with fresh water (refer to [Section 7.15](#)).
 7. Check defrost drain pans and drain lines for obstructions and clear if necessary. Wash with fresh water.
 8. Check panels on refrigeration unit for loose bolts and condition of panels. Make sure T.I.R. devices are in place on access panels.
 - b. Check condenser coil for cleanliness. Wash with fresh water (refer to [Section 7.10](#)).
 - c. Open control box door. Check for loose electrical connections or hardware.
 - d. Check color of moisture- liquid indicator.

5.2 CONNECT POWER

WARNING

Do not attempt to remove power plug(s) before turning OFF start- stop switch (ST), unit circuit breaker(s) and external power source.

WARNING

Make sure the power plugs are clean and dry before connecting to power receptacle.

5.2.1 Connection To 380/460 VAC Power

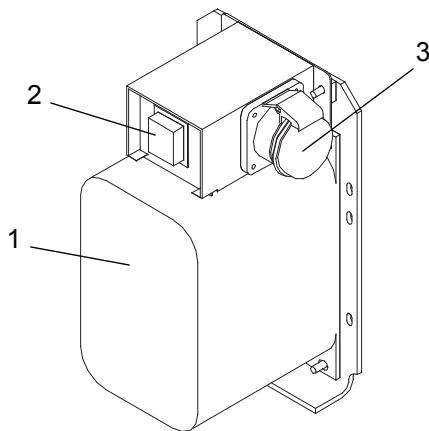
1. Make sure start- stop switch (ST on control panel) and circuit breaker (CB- 1 in the control box) are in position "0" (OFF).
2. Plug the 460 VAC (yellow) cable into a de- energized 380/460 VAC, 3- phase power source. Energize the power source. Place circuit breaker (CB- 1) in position "I" (ON). Close and secure control box door.

5.2.2 Connection To 190/230 VAC Power

An autotransformer ([Figure 5.1](#)) is required to allow operation on nominal 230 volt power. It is fitted with a 230 VAC cable and a receptacle to accept the standard 460 VAC power plug. The 230 volt cable is black in color while the 460 volt cable is yellow. The transformer may also be equipped with a circuit breaker (CB-2). The transformer is a step up transformer that will provide 380/460 VAC, 3-phase, 50/60 Hz power to the unit when the 230 VAC power cable is connected to a 190/230 VAC, 3-phase power source.

1. Make sure that the start-stop switch (ST, on control panel) and circuit breakers CB-1 (in the control box and CB- 2 (on the transformer) are in position "0" (OFF). Plug in and lock the 460VACpower plug at the receptacle on the transformer.
2. Plug the 230 VAC (black) cable into a de- energized 190/230 VAC, 3-phase power source. Energize the power source. Set circuit breakers CB-1 and CB-2 to position "I" (ON). Close and secure control box door.

Figure 5.1 Autotransformer



1. Dual Voltage Modular Autotransformer
2. Circuit Breaker (CB- 2) 230- Volt
3. 460 VAC Power Receptacle

5.3 ADJUST FRESH AIR MAKEUP VENT

The purpose of the fresh air makeup vent is to provide ventilation for commodities that require fresh air circulation. The vent *must be closed* when transporting frozen foods.

Air exchange depends on static pressure differential, which will vary depending on the container and how the container is loaded.

Units may be equipped with a vent position sensor (VPS). The VPS determines the position of the fresh air vent (upper or lower, as equipped) and sends data to the controller display.

5.3.1 Upper Fresh Air Makeup Vent

Two slots and a stop are designed into the Upper Fresh Air disc for air flow adjustments. The first slot allows for a 0 to 30% air flow; the second slot allows for a 30 to 100% air flow.

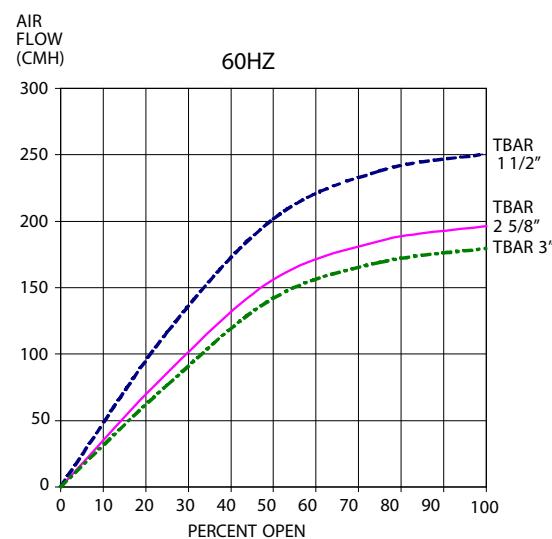
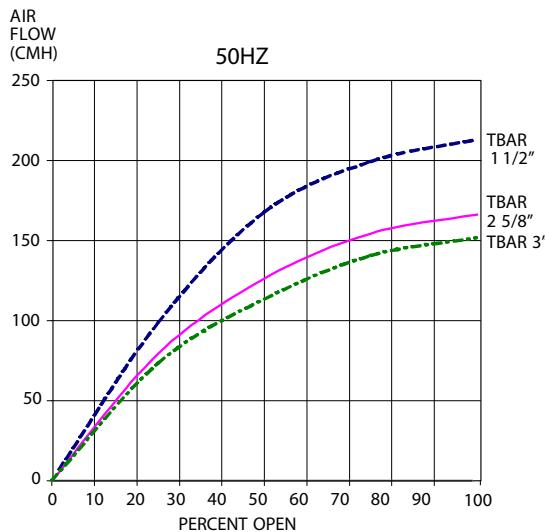
To adjust the percentage of air flow, loosen the wing nut and rotate the disc until the desired percentage of air flow matches with the arrow. Tighten the wing nut.

To clear the gap between the slots, loosen the wing nut until the disc clears the stop.

Figure 5.2 gives air exchange values for an empty container.

Higher values can be expected for a fully loaded container.

Figure 5.2 Upper Fresh Air Make Up Flow Chart



5.3.2 Lower Fresh Air Makeup Vent

a. Full Open or Closed Positions

Maximum air flow is achieved by loosening the wing nuts and moving the cover to the maximum open position (100% position). The closed position is 0% air flow position. The operator may also adjust the opening to increase or decrease the air flow volume to meet the required air flow.

b. Reduced Flow for Lower Fresh Air Makeup

NOTE

In order to prevent inaccurate display readings on units equipped with a Vent Position Sensor (VPS), ensure that the rack and pinion drive of the VPS is not disrupted when adjusting the air makeup vent.

NOTE

Do not loosen the hex nut beyond its stop. Doing so may cause inaccurate display readings and errors in DataCORDER reports.

Similar to the Upper Fresh Air Makeup vent, two slots and a stop are designed into the Lower Fresh Air slide for air flow adjustments. The first slot allows for a 0 to 25% air flow; the second slot allows for a 25 to 100% air flow. To adjust the percentage of air flow, loosen the hex nut and rotate the disc until the desired percentage of air flow matches with the arrow. Tighten the hex nut. To clear the gap between the slots, loosen the hex nut until the disc clears the stop.

On some models the air slide is supplied with two adjustable air control discs. The fresh air makeup can be adjusted for 15, 35, 50 or 75 cubic meters per hour (CMH). The air flow has been established at 60 Hz power and 2- 1/2 inch T bar and with 15 mm (0.6 inch) H₂O external static above free blow.

Loosen the hex nut, adjust each disc to the required air flow, then tighten hex nut.

NOTE

The main air slide is in the fully closed position during reduced air flow operation when equipped with air control discs.

c. Air Sampling for Carbon Dioxide (CO₂) Level

Loosen hex nuts and move the cover until the arrow on the cover is aligned with the “atmosphere sampling port” label. Tighten the hex nuts and attach a 3/8 in. hose to the sampling port.

If the internal atmosphere content has reached an unacceptable level, the operator may adjust the disc opening to meet the required air flow volume to ventilate the container.

5.3.3 Vent Position Sensor

The VPS allows the user to determine the position of the fresh air vent via Cd45. This function code is accessible via the Code Select key.

The vent position will display for 30 seconds whenever motion corresponding to 5 CMH (3 CFM) or greater is detected. It will scroll in intervals of 5 CMH (3 CFM). Scrolling to Cd45 will display the Fresh Air Vent Position.

The position of the vent will be recorded in the DataCORDER whenever the unit is running under AC power and any of the following:

Trip start

On every power cycle

Midnight

Manual changes greater than 5 CMH (3 CFM) remaining in the new position for at least four minutes

NOTE

The user has four minutes to make necessary adjustments to the vent setting. This time calculation begins on the initial movement of the sensor. The vent can be moved to any position within the four minutes. On completion of the first four minutes, the vent is required to remain stable for the next four minutes. If vent position changes are detected during the four-minute stability period, AL50 will be generated. This provides the user with the ability to change the vent setting without generating multiple events in the DataCORDER.

5.4 EAUTOFRESH OPERATION

The eAutoFresh system allows the opening and closing of the mechanical air vent slide. The opening and closing of the slide is determined by the mode selected through Cd43.

The modes of operation are OFF, USER, TEST, DELAY, and GASLIMIT. Each mode of operation has submenus with selectable parameters. Not all parameters are available in each submenu.

Upon power up, the controller will fully close the eAutoFresh air vent. Nine seconds after power up, the controller will check if there is a carbon dioxide (CO₂) sensor connected. When a CO₂ sensor is detected, the controller will enable access to the Gas Limit mode of operation. If no sensor is detected, the only modes of operation available will be Test, User, and Delay. The controller will then resume operation in the last mode of operation before power interruption.

5.4.1 eAutoFresh Pre- Trip Inspection

Pre- trip testing of the eAutoFresh system is performed during Pre- Trip test P0. Operation of the system may be observed during this test.

Upon initiation of Pre- Trip P0, the current state will be saved and the vent will fully close. This will be followed by two sequences of opening to 100% and returning to the closed position. No other eAutoFresh mode of operation will be available until the two cycles of opening and closing have completed. Upon termination of the test, the vent will open to the previous state and operation will return to the previous mode.

If the last mode was gASLM, the vent will open to the preset FLO setting, the controller will start taking new readings and control based on those readings.

5.4.2 AutoFresh Start- Up Procedure

To start the system, do the following:

- a. Press the “CODE SELECT” key (see **Figure 4.2**).
- b. Press the “UP or DOWN” arrow key until “Cd43” is displayed, then press “ENTER”.

- c. Press the “UP or DOWN” arrow key to access the desired mode of operation. When the mode operation is displayed press the enter key to access the submenu parameters.

5.4.3 eAutoFresh Modes of Operation

NOTE

When setting any mode of operation, complete the entire process to ensure all parameters are set.

a. OFF

A setting of OFF will disable all automatic venting operations. The eAutoFresh vent will be driven fully closed and the eAutoFresh opening set to 0 CMH in Cd44. This is the default mode whenever a frozen mode of operation has been selected. When the frozen set point is selected, the current eAutoFresh setting is saved. The vent position will be restored when a perishable set point is selected.

b. USER

The USER mode provides ventilation for commodities that require fresh air circulation. The flow rate can be accessed through the submenu if a perishable set point has been selected. To set the flow rate, press the ENTER key to activate the selection mode. When FLO appears in the left hand window, use the UP or DOWN arrow key to scroll to the desired opening. The range is from 0 to 220CM (0 to 129CF) in increments of 5. Press the ENTER key to set the value and begin operation.

c. TEST

TEST mode allows the operator to test the movement of the mechanical slide air vent and calibrate the CO₂ sensor.

tEST - When “tEST” appears in the left window, press the ENTER key to begin the test. The eAutoFresh slide will open fully and then return to the closed position. The test may be observed by the operator to ensure proper operation of the vent. After completion of the TEST, the unit will return to the previous mode of operation.

NOTE

It is recommended that the calibration procedure only be performed during Pre- trip or when the container has been fully vented.

CAL will attempt to calibrate the CO₂ sensor. When “CAL” is selected the display will flash “CAL”. The operator is to hold the “ENTER” key for 5 seconds. The display will stop flashing and read “CAL” for 5 seconds. The microprocessor will read the CO₂ value, and then compare that value to a known zero value. If the sensor is within the calibration parameter range, the microprocessor will determine the appropriate offset for the sensor. If the sensor is outside of this range, for example if the container is loaded or has a high level of CO₂, the controller will flash “NOCAL” for 5 seconds then revert to the previous mode of operation.

d. DELAY

In DELAY mode, the operation of the eAutoFresh system will be delayed for a set amount of time. This allows time for the cargo to reach set point. In DELAY mode, the eAutoFresh vent will open to the stored (FLO) value when the return air temperature sensor (RTS) is at or below set point plus the return offset value (rtn) or the delay time (tIM), whichever comes first. The eAutoFresh vent will be fully closed when return air temperature is greater than the set point plus the offset temperature (rtn).

To set the unit in Delay mode, scroll until “DELAY” appears in the left window, press ENTER to activate the submenu. The first selection is the amount of time (tIM) for the delay. Select the amount of time for the delay by using the UP and DOWN arrow keys. The range is from 1 to 72 hours in 1 hour increments. Press the ENTER key to set the value and move to the FLO rate. Use the UP or DOWN arrow key to scroll to the desired FLO rate. The range is from 0 to 220CM (0 to 129CF) in increments of 5 and 3 respectively. Press the ENTER key to set the value and move to the return temperature offset. Use the UP or DOWN arrow key to scroll to the desired rtn rate. The range of offset is from 0.6°C to 2.8°C (1.0° F to 2.8° F) in 0.1° increments. Press ENTER to set the value and begin operation.

e. GAS LIMIT (gASLM)

In GAS LIMIT mode, access to the submenu is available provided a perishable set point has been selected, and a valid reading is detected from the CO₂ sensor. In “Gas limit” mode the microprocessor will monitor and limit the level of CO₂ in the container by opening and closing the eAutoFresh vent. The vent will open to the (FLO) setting once the unit has completed initial temperature pull down or if the cargo temperature is within 5°C of set point and the CO₂ level has reached the max limit or if the O₂ level has reached the lower limit. After the first 15 minutes of the vent opening the controller will again evaluate the level of CO₂, and/or O₂ levels. If after the first 15 minutes the gas limit values are satisfied, the vent will close, if either gas limit has not been satisfied within 15 minutes the air exchange vent will open in 10 CMH increments every 15 minutes until both gas concentrations are satisfied. Once all limits are satisfied the vent will return to the closed position. If conditions are not met with the slide open 100% for 90 minutes AL29 will be activated.

To operate in GAS LIMIT mode, scroll until gASLM appears in the left window, and press ENTER to activate the submenu. The first selection is the maximum CO₂ level (CO2LM). Select the maximum CO₂ level by using the UP and DOWN arrow keys. The range is from 0 to 19% in 1% increments. Press ENTER to set the value and move to the minimum O₂ level (O2LM). The range is from 2% to 20% in 1% increments. Press ENTER to set the value and move to the FLO rate. Use the UP or DOWN arrow key to scroll to the desired FLO rate. The range is from 0 to 220CM (0 to 129CF) in increments of 5 and 3 respectively. Press ENTER to set the value and begin operation.

Operational Parameters (Sub Menu Options):

FLO indicates the opening to which the slide will move based on the stored value in CMH (in increments of 5) or CFM depending on the selection of Cd46 (Airflow display units), Cd28 (Metric/Imperial) or the pressing of the deg C/F key. CFM is displayed as CF, CMH is displayed as CM.

tIM is the time delay prior to the door opening. The time range is from 1 to 72 hrs in 1 hr increments.

CO2LM is the maximum level of CO₂ that is allowed for the cargo. The range is from 0% to 19% in 1% increments, the default setting is 10.

O2LM is the minimum level of O₂ that is allowed for the cargo. The range is from 2% to 20% in 1% increments, the default setting is 10.

Rtn is an offset value used to expand the return air temperature value to compensate for the fresh air entering the container. The allowable range is from 0.6°C to 2.8°C or 1.0°F to 5.0°F in 0.1° increments the default setting is 2.8°C (5°F).

5.5 CONNECT REMOTE MONITORING RECEPTACLE

If remote monitoring is required, connect the remote monitor plug at the unit receptacle, see [Figure 3.5](#).

When the remote monitor plug is connected to the remote monitoring receptacle, the following remote circuits are energized:

CIRCUIT	FUNCTION
Sockets B to A	Energizes remote cool light
Sockets C to A	Energizes remote defrost light
Sockets D to A	Energizes remote in-range light

5.6 STARTING AND STOPPING INSTRUCTIONS

⚠ WARNING

Make sure that the unit circuit breaker(s) (CB-1 & CB-2) and the START-STOP switch (ST) are in the “O” (OFF) position before connecting to any electrical power source.

NOTE

The electronic phase detection system will check for proper compressor rotation within the first 30 seconds. If rotation is not correct, the compressor will be stopped and restarted in the opposite direction. If the compressor is producing unusually loud and continuous noise after the first 30 seconds of operation, stop the unit and investigate.

5.6.1 Starting the Unit

- With power properly applied, the fresh air vent in proper position, place the START-STOP switch to “I” (ON), see [Figure 3.5](#).

- The Controller Function Codes for the container ID (Cd40), software version (Cd18) and unit model number (Cd20) will be displayed in sequence.
- Continue with Start Up Inspection, [Section 5.7](#).

5.6.2 Stopping the Unit

To stop the unit, place the START-STOP switch in position “0” (OFF).

5.7 START-UP INSPECTION

5.7.1 Physical Inspection

Check rotation of condenser and evaporator fans.

5.7.2 Check Controller Function Codes

Check, and if required, reset controller Function Codes (Cd27 through Cd39) in accordance with desired operating parameters. Refer to [Table 4-5](#).

5.7.3 Start Temperature Recorder

DataCORDER

- Check and, if required, set the DataCORDER Configuration in accordance with desired recording parameter. Refer to [Section 4.8.3](#).

- Enter a “Trip Start.” To enter a “Trip Start,” do the following:

- Depress the ALT MODE key. When the left display shows, dC, depress the ENTER key.
- Scroll to Code dC30.
- Depress and hold the ENTER key for five seconds.
- The “Trip Start” event will be entered in the DataCORDER.

5.7.4 Complete Inspection

Allow the unit to run for five minutes to stabilize conditions, and then perform a Pre-trip diagnosis in accordance with [Section 5.8](#).

5.8 PRE-TRIP DIAGNOSIS

⚠ CAUTION

Pre-trip inspection should not be performed with critical temperature cargoes in the container.

⚠ CAUTION

When Pre-trip key is pressed, economy, dehumidification and bulb mode will be deactivated. At the completion of Pre-trip activity, economy, dehumidification and bulb mode must be reactivated.

Pre-trip diagnosis provides automatic testing of the unit components using internal measurements and comparison logic. The program will provide a "PASS" or "FAIL" display to indicate test results.

The testing begins with access to a Pre-trip selection menu. The user may have the option of selecting one of two automatic tests.

These tests will automatically perform a series of individual Pre-trip tests. The user may also scroll down to select any of the individual tests.

When only the short sequence is configured, it will appear as "AUtO" in the display. Otherwise "AUtO1" will indicate the short sequence and "AUtO2" will indicate the long sequence. The test short sequence will run tests P0 through P6. The long test sequence will run tests P0 through P10.

A detailed description of the Pre-trip test codes is listed in **Table 4-6**. If no selection is made, the Pre-trip menu selection process will terminate automatically. However, dehumidification and bulb mode must be reactivated manually if required.

Scrolling down to the "rSLts" code and pressing ENTER will allow the user to scroll through the results of the last Pre-trip testing run. If no Pre-testing has been run (or an individual test has not been run) since the unit was powered up, "----" will be displayed.

To start a Pre-trip test, do the following:

NOTE

1. Prior to starting a Pre-trip test, verify that unit voltage (Cd07) is within tolerance and unit amperage draw (Cd04, Cd05, Cd06) are within expected limits. Otherwise, tests may fail incorrectly.
2. All alarms must be rectified and cleared before starting tests.
3. Pre-trip may also be initiated via communications. The operation is the same as for the keypad initiation described below except that should a test fail, the Pre-trip mode will automatically terminate. When initiated via communications, a Pre-trip test may not be interrupted with an arrow key, but the Pre-trip test can be terminated with the PRE-TRIP key.
 - a. Press the PRE-TRIP key to access the Pre-trip test selection menu.
 - b. TO RUN AN AUTOMATIC TEST: Scroll through the selections by pressing the UP ARROW or DOWN ARROW keys to display AUTO, AUTO 1, AUTO 2 or AUTO 3 as desired, then press ENTER.
 1. The unit will execute the series of tests without any need for direct user interface. These tests vary in length, depending on the component under test.

2. While tests are running, "P#- #" will appear on the left display; the #'s indicate the test number and sub-test. The right display will show a countdown time in minutes and seconds, indicating the amount of time remaining in the test.

CAUTION

When a failure occurs during automatic testing, the unit will suspend operation awaiting operator intervention.

When an automatic test fails, it will be repeated once. A repeated test failure will cause "FAIL" to be shown on the right display, with the corresponding test number to the left.

The user may then press the DOWN ARROW to repeat the test, the UP ARROW to skip to the next test, or the PRE-TRIP key to terminate testing. The unit will wait indefinitely or until the user manually enters a command.

CAUTION

When Pre-trip test Auto2 runs to completion without being interrupted, the unit will terminate Pre-trip and display "Auto 2" "end." The unit will suspend operation until the user depresses the ENTER key!

When an Auto 1 Pre-trip test runs to completion without a failure, the unit will exit Pre-trip mode and return to normal control operation. However, dehumidification and bulb mode must be reactivated manually if required.

c. TO RUN AN INDIVIDUAL TEST: Scroll through the selections by pressing the UP ARROW or DOWN ARROW keys to display an individual test code. Pressing ENTER when the desired test code is displayed.

1. Individually selected tests, other than the LED/Display test, will perform the operations necessary to verify the operation of the component. At the conclusion, PASS or FAIL will be displayed. This message will remain displayed for up to three minutes, during which time a user may select another test. If the three minute time period expires, the unit will terminate pre-trip and return to control mode operation.
2. While the tests are being executed, the user may terminate the pre-trip diagnostics by pressing and holding the PRE-TRIP key. The unit will then resume normal operation. If the user decides to terminate a test but remain at the test selection menu, the user may press the UP ARROW key. When this is done, all test outputs will be de-energized and the test selection menu will be displayed.
3. During Pre-trip testing, current limiting and pressure limiting are both active, except during P-7 (High Pressure Switch Testing) when pressure limiting is turned off.

d. Pre-Trip Test Results

At the end of the pre-trip test selection menu, the message "P," "rSLts" (Pre-trip results) will be displayed. Pressing the ENTER key will allow the user to see the results for all subtests (i.e., 1-0, 1-1, etc).

The results will be displayed as "PASS" or "FAIL" for all the tests run to completion since power up. If a test has not been run since power up, "----" will be displayed. Once all Pre-test activity is completed, dehumidification and bulb mode must be reactivated manually if required.

5.9 PROBE DIAGNOSTICS

A complete temperature probe check is performed during the P5 Pre-trip test. A probe check is also run at the end of a defrost cycle; the defrost light will remain on during this period. If supply probes are within limits and return probes are within limits, the unit will return to normal operation. During normal operation, the controller continuously monitors and compares adjacent temperature probe readings.

The probe check procedure consists of running the evaporator fans for up to eight minutes in order to compare the readings from the adjacent temperature probes. If a significant difference in temperature readings is detected between probes, a defrost cycle, followed by another probe check may be initiated. Any continued disagreement between probes will prompt the controller to invalidate the failed temperature probe, and the backup probe will be used for temperature control.

In Perishable Mode, both pairs of supply and return probes are monitored for probe disagreement. Probe disagreement is considered a difference of 0.5°C (0.9°F) or greater between the supply air sensors and/or a difference of 2.0°C (3.6°F) between the return air sensors. Probe disagreement found in either pair can trigger a defrost probe check.

In Frozen Mode, only the controlling probes are considered. Disagreement of the controlling probes can trigger a defrost probe check, which will occur when the difference between the sensors is greater than 2.0°C (3.6°F). Normally, the controlling probes are the return probes but if both return probes are invalidated, the supply probes are used for control purposes. Probe disagreement of the non-controlling probe pair will not trigger a defrost probe check.

If after the defrost probe check the supply probes agree and return probes agree, all supply and return sensors are considered valid and the unit returns to normal control.

In the Case of Probe Disagreement:

If the supply probes disagree and the return probes agree, the controller will invalidate the worst supply probe. If the probe check is run as part of Pre-trip P-5, an alarm will be triggered for the invalidated probe. If it is a run time defrost probe check, the invalidated probe will be passed over and no alarm will be triggered. However, if the best supply probe is greater than 1.2°C (2.2°F) dif-

ference with respect to its return probes, the best supply probe is also invalidated. If unit is in Perishable Mode, a probe alarm will be triggered for both supply probes.

If the supply probes agree and the return probes disagree, invalidate the worst return probe. If the probe check is being run as part of Pre-trip P-5, an alarm will be triggered for the invalidated probe. If it is a run time defrost probe check, the invalidated probe will be passed over and no alarm will be necessary. If the best return probe is greater than 1.2°C (2.2°F) difference with respect to its supply probes, then the best return probe is also invalidated. If the unit is in perishable mode, a probe alarm will be triggered for both return probes.

5.10 EMERGENCY BYPASS OPERATION (OPTION)

Emergency Bypass operation is used to override the controller, in the case of a controller malfunction, to keep the unit cooling. When Emergency Bypass is installed and turned on, the unit will remain in a continuous state of full cool until the Emergency Bypass switch is turned off.

To place the unit in the Emergency Bypass Operation:

- a. Locate the connection diagram and connectors for the emergency bypass (EB) sensors behind the top left side of the compressor.
- b. Disconnect the emergency bypass connector from the controller connector and attach it to the emergency bypass module connector. See **Figure 5.3**.
- c. Locate the wire tie located at the EB switch in the control box.
- d. Cut the wire tie, then place the EB switch in the On position.
- e. Place the Mode Switch (MS) in the Full Cool position to enable the system for cooling.
- f. Manually control container air temperature by cycling the Mode switch between Full Cool and evaporator Fans Only.

To operate the fans only, the MODE switch must be in the FANS ONLY position and the EMERGENCY BYPASS switch must be in the Bypass position.

The EBS module uses the system's safety devices (high pressure switch, motor internal protectors, and heat termination thermostat) to protect the system while in Emergency Bypass Mode.

CAUTION

The unit will remain in the full cooling mode as long as the EB switch is in the On position and the Mode Switch is in the Full Cool position. If the cargo can be damaged by low temperatures, the operator must monitor container temperature and manually cycle operation as required to maintain temperature within required limits.

When the Emergency Bypass switch is in the Bypass position, the EBS will be enabled. With the Mode switch in Full Cool mode, the following will occur simultaneously:

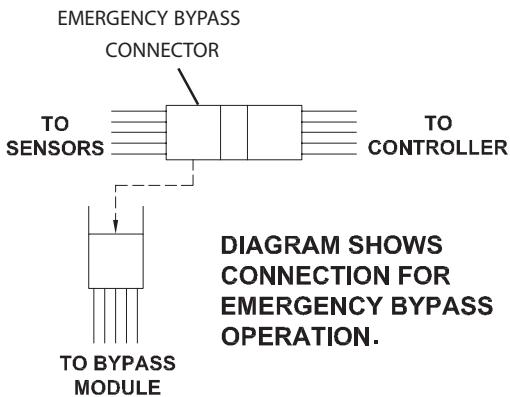
- a. The EBS switch will enable EBS input.
- b. The phase detection circuit will detect the phase rotation and close to provide power to the compressor contactor.
- c. The condenser fan contact will close to energize the condenser contactor and provide power to the condenser fan motor.
- d. The evaporator fan contact will close to energize the high speed evaporator contactor and provide power to the evaporator fan motor.
- e. The EBS electronic module will operate the EEV to control superheat.

To return the unit to normal operation:

1. Locate the connectors behind the compressor.
2. Disconnect the Emergency Bypass connector from the EBS module connector and reconnect it to the controller connector. See [Figure 5.3](#).

3. Inside the control box, place the EB switch in the Off position.
4. Re-install the wire tie at the switch mounting.

Figure 5.3 Diagram of Emergency Bypass Connections



SECTION 6

TROUBLESHOOTING

Table 6–1 TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY/REFERENCE SECTION
6.1 UNIT WILL NOT START OR STARTS THEN STOPS		
No power to unit	External power source OFF	Turn on
	Start-Stop switch OFF or defective	Check
	Circuit breaker tripped or OFF	Check
	Autotransformer not connected	Section 5.2.2
Loss of control power	Circuit breaker OFF or defective	Check
	Control transformer defective	Replace
	Fuse (F3A/F3B) blown	Check
	Start-Stop switch OFF or defective	Check
Component(s) not operating	Evaporator fan motor internal protector open	Section 7.14
	Condenser fan motor internal protector open	Section 7.8
	Compressor internal protector open	Section 7.8
	High pressure switch open	Section 6.7
	Heat termination thermostat open	Replace
	Malfunction of current sensor	Replace
Compressor hums, but does not start	Low line voltage	Check
	Single phasing	Check
	Shorted or grounded motor windings	Section 7.8
	Compressor seized	Section 7.8
6.2 UNIT OPERATES LONG OR CONTINUOUSLY IN COOLING		
Container	Hot load	Normal
	Defective box insulation or air leak	Repair
Refrigeration system	Shortage of refrigerant	Section 7.3
	Evaporator coil covered with ice	Section 6.6
	Evaporator coil plugged with debris	Section 7.13
	Evaporator fan(s) rotating backwards	Section 7.13/Section 7.14
	Air bypass around evaporator coil	Check
	Controller set too low	Reset
	Compressor service valves or liquid line shutoff valve partially closed	Open valves completely
	Dirty condenser	Section 7.10.2
	Compressor worn	Section 7.8
	Current limit (function code Cd32) set to wrong value	Section 4.4.3
	Economizer solenoid valve malfunction	Section 7.21
	Digital unloader valve stuck open	Replace
	Electronic expansion valve	Replace

Table 6–1 TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY/REFERENCE SECTION
6.3 UNIT RUNS BUT HAS INSUFFICIENT COOLING		
Refrigeration system	Abnormal pressures	Section 6.7
	Abnormal temperatures	Section 6.15
	Abnormal currents	Section 6.16
	Controller malfunction	Section 6.9
	Evaporator fan or motor defective	Section 7.14
	Compressor service valves or liquid line shutoff valve partially closed	Open valves completely
	Frost on coil	Section 6.10
	Digital unloader valve stuck open	Replace
	Electronic expansion valve	Replace
6.4 UNIT WILL NOT HEAT OR HAS INSUFFICIENT HEATING		
No operation of any kind	Start-Stop switch OFF or defective	Check
	Circuit breaker OFF or defective	Check
	External power source OFF	Turn ON
No control power	Circuit breaker or fuse defective	Replace
	Control Transformer defective	Replace
	Evaporator fan internal motor protector open	Section 7.14
	Heat relay defective	Check
	Heater termination thermostat open	Section 7.13
Unit will not heat or has insufficient heat	Heater(s) defective	Section 7.13
	Heater contactor or coil defective	Replace
	Evaporator fan motor(s) defective or rotating backwards	Section 7.13/Section 7.14
	Evaporator fan motor contactor defective	Replace
	Controller malfunction	Section 6.9
	Defective wiring	Replace
	Loose terminal connections	Tighten
	Low line voltage	Section 3.3
6.5 UNIT WILL NOT TERMINATE HEATING		
Unit fails to stop heating	Controller improperly set	Reset
	Controller malfunction	Section 6.9
	Heater termination thermostat remains closed along with the heat relay	Section 7.13
6.6 UNIT WILL NOT DEFROST PROPERLY		
Will not initiate defrost automatically	Defrost timer malfunction (Cd27)	Table 4–4
	Loose terminal connections	Tighten
	Defective wiring	Replace
	Defrost temperature sensor defective or heat termination thermostat open	Replace
	Heater contactor or coil defective	Replace

Table 6-1 TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY/REFERENCE SECTION
Will not initiate defrost manually	Manual defrost switch defective	Replace
	Keypad is defective	Replace
	Defrost temperature sensor open	Replace
Initiates but relay (DR) drops out	Low line voltage	Section 3.3
Initiates but does not defrost	Heater contactor or coil defective	Replace
	Heater(s) burned out	Section 7.13
Frequent defrost	Wet load	Normal
6.7 ABNORMAL PRESSURES		
High discharge pressure	Condenser coil dirty	Section 7.10.2
	Condenser fan rotating backwards	Section 7.10
	Condenser fan inoperative	Section 7.11
	Refrigerant overcharge or noncondensables	Section 7.3
	Discharge service valve partially closed	Open
	Electronic expansion valve (EEV) control malfunction	Replace
Low suction pressure	Incorrect software and/or controller configuration	Check
	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	Suction service valve partially closed\	Open
	Filter drier partially plugged	Section 7.12
	Low refrigerant charge	Section 7.3
	No evaporator air flow or restricted air flow	Section 7.13
	Excessive frost on evaporator coil	Section 6.6
	Evaporator fan(s) rotating backwards	Section 7.14.3
	EEV control malfunction	Replace
Suction and discharge pressures tend to equalize when unit is operating	Failed digital unloader valve (DUV)	Replace
	Compressor operating in reverse	Section 6.14
	Compressor cycling/stopped	Check
	Failed digital unloader valve (DUV)	Replace
6.8 ABNORMAL NOISE OR VIBRATIONS		
Compressor	Compressor start up after an extended shutdown	Normal
	Brief chattering when manually shut down	
	Compressor operating in reverse	Section 6.14
	Loose mounting bolts or worn resilient mounts	Tighten/Replace
	Loose upper mounting	Section 7.8.1
	Loose slugging	Section 7.13
Condenser or Evaporator Fan	Bent, loose or striking venturi	Check
	Worn motor bearings	Section 7.11/Section 7.14
	Bent motor shaft	Section 7.11/Section 7.14

Table 6–1 TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY/REFERENCE SECTION
6.9 MICROPROCESSOR MALFUNCTION		
Will not control	Incorrect software and/or controller configuration	Check
	Defective sensor	Section 7.24
	Defective wiring	Check
	Low refrigerant charge	Section 7.3
6.10 NO EVAPORATOR AIR FLOW OR RESTRICTED AIR FLOW		
Evaporator coil blocked	Frost on coil	Section 6.6
	Dirty coil	Section 7.13
No or partial evaporator air flow	Evaporator fan motor internal protector open	Section 7.14
	Evaporator fan motor(s) defective	Section 7.14
	Evaporator fan(s) loose or defective	Section 7.14
	Evaporator fan contactor defective	Replace
6.11 EAUTOFRESH NOT OPERATING		
Vent not opening	Unit not Configured for eAutoFresh Operation	No action
	Cd43 in Off mode	Section 5.4.2
	Wiring disconnected	Check wiring
	Stepper drive defective	Section 7.26.2
	Stepper motor defective	Section 7.26.4
	Unit operating in frozen mode	Section 5.4.3
Gas Limit mode unavailable	Check CO ₂ sensor	Section 5.4.3
	Wiring disconnected	Check wiring
	Unit operating in frozen mode	Section 5.4.3
Unable to calibrate CO ₂ sensor	“Enter” Key not held for sufficient length of time	Section 5.4.3
	CO ₂ outside of acceptable levels	Check
	Check CO ₂ sensor	Section 5.4.3
Code 44 displays “-----”	Unit not Configured for eAutoFresh Operation	No action
	Check CO ₂ sensor	Section 5.4.3
6.12 ELECTRONIC EXPANSION VALVE MALFUNCTION		
Low suction pressure	Incorrect software and/or controller configuration	Check
	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	Suction service valve partially closed	Open
	Filter drier partially plugged	Section 7.12
	Low refrigerant charge	Section 7.3
	No evaporator air flow or restricted air flow	Section 7.13
	Excessive frost on evaporator coil	Section 6.6
	Evaporator fan(s) rotating backwards	Section 7.14.3
	EEV control malfunction	Section 7.16
	Failed digital unloader valve (DUV)	Replace
Loose or insufficiently clamped sensor	Replace	

Table 6–1 TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	REMEDY/REFERENCE SECTION
High suction pressure with low superheat	Foreign material in valve	Section 7.16
	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	EEV control malfunction	Replace
	Improperly seated powerhead	Ensure powerhead is locked and in place
Liquid slugging in compressor	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	Failed EEV	Replace
6.13 AUTOTRANSFORMER MALFUNCTION		
Unit will not start	Circuit breaker (CB-1 or CB-2) tripped	Check
	Autotransformer defective	Section 7.22
	Power source not turned ON	Check
	460 VAC power plug is not inserted into the receptacle	Section 5.2.2
6.14 COMPRESSOR OPERATING IN REVERSE		
NOTE The compressor may start in reverse for up to 10 seconds to determine correct phase rotation if required for phase detection.		
 CAUTION Allowing the scroll compressor to operate in reverse for more than two minutes will result in internal compressor damage. Turn the start-stop switch OFF immediately.		
Electrical	Incorrect wiring of compressor	Check
	Incorrect wiring of compressor contactor(s)	
	Incorrect wiring of current sensor	
6.15 ABNORMAL TEMPERATURES		
High discharge temperature	Condenser coil dirty	Section 7.10.2
	Condenser fan rotating backwards	Section 7.11
	Condenser fan inoperative	Section 7.11.1
	Refrigerant overcharge or noncondensables	Section 7.3
	Discharge service valve partially closed	Open
	Electronic expansion valve (EEV) control malfunction	Replace
	Failed suction pressure transducer (SPT) or evaporator pressure transducer (EPT)	Replace
	Discharge temperature sensor drifting high	Replace
	Failed economizer expansion valve, economizer coil, or economizer solenoid valve	Replace
	Plugged economizer expansion valve, economizer coil, or economizer solenoid valve	Replace
6.16 ABNORMAL CURRENTS		
Unit reads abnormal currents	Current sensor wiring	Check

SECTION 7

SERVICE

NOTE

Use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws. In the U.S.A., refer to EPA section 608.

! WARNING

EXPLOSION HAZARD Failure to follow this WARNING can result in death, serious personal injury and / or property damage. Never use air or gas mixtures containing oxygen (O_2) for leak testing or operating the product. Charge only with R-134a: Refrigerant must conform to AHRI Standard 700 specification.

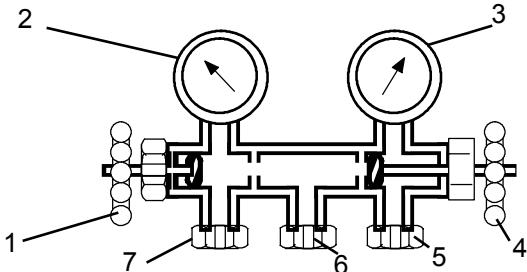
7.1 SECTION LAYOUT

Service procedures are provided in this section beginning with refrigeration system service, then refrigeration system component service, electrical system service, temperature recorder service and general service. Refer to the Table of Contents to locate specific topics.

7.2 MANIFOLD GAUGE SET

The manifold gauge set (see [Figure 7.1](#)) is used to determine system operating pressure, add refrigerant charge, and to equalize or evacuate the system.

Figure 7.1 Manifold Gauge Set



1. Suction Pressure Valve (shown backseated)
2. Suction Pressure Gauge
3. Discharge Pressure Gauge
4. Discharge Pressure Valve (shown frontseated)
5. High Side Connection
6. Utility Connection to:
 - a. Refrigerant cylinder
 - b. Vacuum Pump
 - c. Oil Container
7. Low Side Connection

When the Suction Pressure Valve (1) is frontseated (turned all the way in), the suction (low) pressure can be checked at the Suction Pressure Gauge (2).

When the Discharge Pressure Valve (4) is frontseated, the discharge (high) pressure can be checked at the Discharge Pressure Gauge (3).

When both valves are backseated (all the way out), high pressure vapor will flow into the low side.

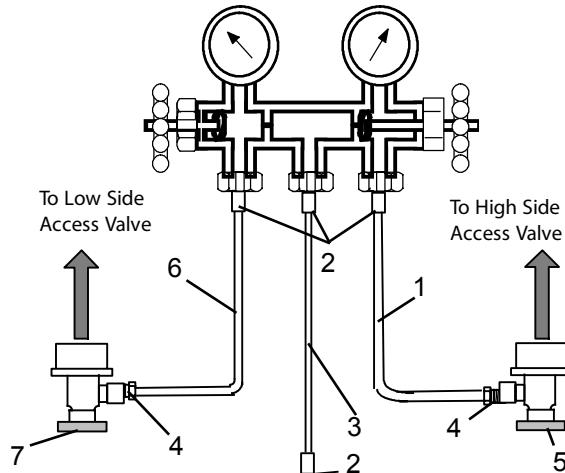
When the Suction Pressure Valve (1) is open and the Discharge Pressure Valve (4) shut, the system can be charged through the Utility Connection (6). Oil can also be added to the system.

A R-134a manifold gauge/hose set with self-sealing hoses (see [Figure 7.2](#)) is required for service of the models covered within this manual. The manifold gauge/hose set is available from Carrier Transicold. (Carrier Transicold part number 07-00294-00, which includes items 1 through 6, [Figure 7.2](#).)

If the manifold gauge/hose set is new or was exposed to the atmosphere, it will need to be evacuated to remove contaminants and air as follows:

1. Backseat (turn counterclockwise) both field service couplings (see [Figure 7.2](#)) and midseat both hand valves.
2. Connect the yellow hose to a vacuum pump and refrigerant 134a cylinder.
3. Evacuate to 10 inches of vacuum and then charge with R-134a to a slightly positive pressure of 0.1 kg/ cm² (1.0 psig).
4. Frontseat both manifold gauge set valves and disconnect from cylinder. The gauge set is now ready for use.

Figure 7.2 R-134a Manifold Gauge/Hose Set



1. RED Refrigeration and/or Evacuation Hose (SAE J2196/R-134a)
2. Hose Fitting (0.5-16 Acme)
3. YELLOW Refrigeration and/or Evacuation Hose (SAE J2196/R-134a)
4. Hose Fitting with O-ring (M14 x 1.5)
5. High Side Field Service Coupling (Red Knob)
6. BLUE Refrigeration and/or Evacuation Hose (SAE J2196/R-134a)
7. Low Side Field Service Coupling (Blue Knob)

7.3 SERVICE CONNECTIONS

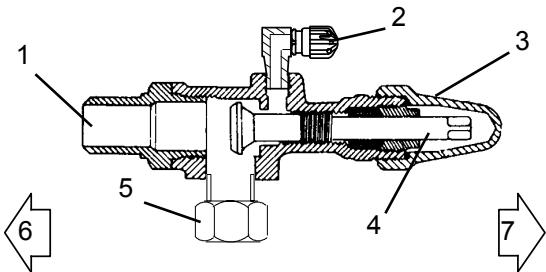
The compressor suction, compressor discharge, and the liquid line service valves (see **Figure 7.3**) are provided with a double seat and an access valve which enables servicing of the compressor and refrigerant lines.

Turning the valve stem clockwise (all the way forward) will frontseat the valve to close off the line connection and open a path to the access valve. Turning the stem counterclockwise (all the way out) will backseat the valve to open the line connection and close off the path to the access valve.

With the valve stem midway between frontseat and backseat, both of the service valve connections are open to the access valve path.

For example, the valve stem is first fully backseated when connecting a manifold gauge to measure pressure. Then, the valve is opened 1/4 to 1/2 turn to measure the pressure.

Figure 7.3 Service Valve



1. Line Connection
2. Access Valve
3. Stem Cap
4. Valve stem
5. Compressor Or Filter Drier Inlet Connection
6. Valve (Frontseated)
7. Valve (Backseated)

Connection of the manifold gauge/hose set (see **Figure 7.4**) is dependent on the component being serviced. If only the compressor is being serviced, the high side coupling is connected to the discharge service valve.

For service of the low side (after pump down), the high side coupling is connected to the liquid line service valve. The center hose connection is brought to the tool being used (vacuum, tank, etc.).

Connecting the manifold gauge set:

- a. Remove service valve stem cap and to make sure the valve is backseated.
- b. Remove access valve cap (See **Figure 7.3**).
- c. Connect the field service coupling (see **Figure 7.2**) to the access valve.
- d. Turn the field service coupling knob clockwise, which will open the system to the gauge set.
- e. To read system pressures, slightly midseat the service valve.
- f. Repeat the procedure to connect the other side of the gauge set.

CAUTION

To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

Removing the Manifold Gauge Set:

- a. While the compressor is still ON, backseat the high side service valve.
- b. Midseat both hand valves on the manifold gauge set and allow the pressure in the manifold gauge set to be drawn down to low side pressure. This returns any liquid that may be in the high side hose to the system.
- c. Backseat the low side service valve. Backseat both field service couplings and frontseat both manifold hand valves. Remove couplings from access valves.
- d. Install both service valve stem caps and service port caps (finger-tight only).

7.4 PUMP DOWN THE UNIT

To service the filter drier, economizer, expansion valves, economizer solenoid valve, digital unloader valve or evaporator coil, pump the refrigerant into the high side as follows:

CAUTION

The scroll compressor achieves low suction pressure very quickly. Do not use the compressor to evacuate the system below 0 psig. Never operate the compressor with the suction or discharge service valves closed (frontseated). Internal damage will result from operating the compressor in a deep vacuum.

Automatic Pump Down:

To perform an Automatic Pump Down using Cd59Pump Down Logic, refer to **Table 4–5** Controller Function Codes.

Manual Pump Down:

- a. Attach manifold gauge set to the compressor suction and discharge service valves. Refer to **Section 7.2**.
- b. Start the unit and run in the frozen mode (controller set below -10°C (14°F) for 10 to 15 minutes.
- c. Check function code Cd21 (refer to **Section 4.2.2**). The economizer solenoid valve should be open. If not, continue to run until the valve opens.
- d. Frontseat the liquid line service valve. Place Start- Stop switch in the OFF position when the suction reaches a positive pressure of 0.1 bar (1.4 psig).
- e. Frontseat the suction and discharge service valves. The refrigerant will be trapped between the compressor discharge service valves and the liquid line valve.
- f. Before opening up any part of the system, a slight positive pressure should be indicated on the pressure gauge. Remove power from the unit before opening any part of the system. If a vacuum is indicated, emit refrigerant by cracking the liquid line valve momentarily to build up a slight positive pressure.
- g. When opening up the refrigerant system, certain parts may frost. Allow the part to warm to ambient temperature before dismantling. This avoids internal condensation which puts moisture in the system.
- h. After repairs have been made, be sure to perform a refrigerant leak check (refer to **Section 7.5**), and evacuate and dehydrate the low side (refer to **Section 7.6.1**).
- i. Check refrigerant charge (refer to **Section 7.6**).

7.5 REFRIGERANT LEAK CHECKING

! WARNING

EXPLOSION HAZARD Failure to follow this **WARNING** can result in death, serious personal injury and / or property damage.

Never use air or gas mixtures containing oxygen (O₂) for leak testing or operating the product.

Charge only with R-134a: Refrigerant

must conform to AHRI Standard 700 specification.

- a. The recommended procedure for finding leaks in a system is with a R-134a electronic leak detector. Testing joints with soapsuds is satisfactory only for locating large leaks.
- b. If the system is without refrigerant, charge the system with refrigerant 134a to build up pressure between 2.1 to 3.5 bar (30.5 to 50.8 psig). To ensure complete pressurization of the system, refrigerant should be charged at the compressor suction valve and the liquid line service valve. Remove refrigerant cylinder and leak-check all connections.

NOTE

Only refrigerant 134a should be used to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional purging and evacuation of the system.

- c. If required, remove refrigerant using a refrigerant recovery system and repair any leaks. Check for leaks.
- d. Evacuate and dehydrate the unit. (Refer to **Section 7.6.1**.)
- e. Charge unit per **Section 7.7.1**.

7.6 EVACUATION AND DEHYDRATION

7.6.1 General

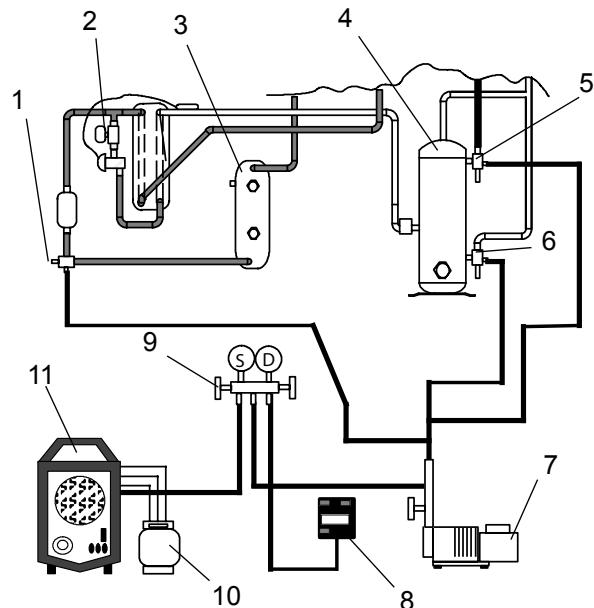
Moisture is detrimental to refrigeration systems. The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, “freezing-up” of metering devices by free water, and formation of acids, resulting in metal corrosion.

7.6.2 Preparation

- a. Evacuate and dehydrate only after pressure leak test (refer to **Section 7.5**).
- b. Essential tools to properly evacuate and dehydrate any system include a vacuum pump (8m³/hr = 5 cfm volume displacement) and an electronic vacuum gauge. The pump is available from Carrier Transicold, P/N 07-00176-11. The micron gauge is P/N 07-00414-00.
- c. If possible, keep the ambient temperature above 15.6°C (60°F) to speed evaporation of moisture. If the ambient temperature is lower than 15.6°C (60°F), ice might form before moisture removal is complete. Heat lamps or alternate sources of heat may be used to raise the system temperature.

- d. Additional time may be saved during a complete system pump down by replacing the filter drier with a section of copper tubing and the appropriate fittings. Installation of a new drier may be performed during the charging procedure.

Figure 7.4 Refrigeration System Service Connections



1. Liquid Service Connection
2. Economizer Solenoid Valve
3. Receiver or Water Cooled Condenser
4. Compressor
5. Discharge Service Connection
6. Suction Service Connection
7. Vacuum Pump
8. Electronic Vacuum Gauge
9. Manifold Gauge Set
10. Refrigerant Cylinder
11. Reclaimer

7.6.3 Complete System

NOTE

Refer to Partial System procedure for information pertaining to partial system evacuation and dehydration.

- a. Remove all refrigerant using a refrigerant recovery system.
- b. The recommended method to evacuate and dehydrate the system is to connect evacuation hoses at the compressor suction and liquid line service valve (see **Figure 7.4**). Be sure the service hoses are suited for evacuation purposes.

NOTE

To prevent the area between the Economizer Solenoid Valve (ESV) and the Compressor from being isolated during

evacuation, it is necessary to open the ESV using a magnet tool, Carrier Transicold part number 07- 00512- 00.

- c. Remove the ESV coil from the valve body. Place the magnet tool over the valve stem, an audible click will be heard when the ESV opens.

NOTE

Make sure to replace the valve coil before restarting the unit. Starting the unit with the coil removed from the valve will burn out the coil.

- d. Test the evacuation setup for leaks by backseating the unit service valves and drawing a deep vacuum with the vacuum pump and gauge valves open. Shut off the pump and check to see if the vacuum holds. Repair leaks if necessary.
- e. Midseat the refrigerant system service valves.
- f. Open the vacuum pump and electronic vacuum gauge valves, if they are not already open. Start the vacuum pump. Evacuate unit until the electronic vacuum gauge indicates 2000 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait a few minutes to be sure the vacuum holds.
- g. Break the vacuum with either clean dry refrigerant 134a or dry nitrogen. Raise system pressure to roughly 0.14 bar (2 psig), monitoring it with the compound gauge.
- h. If R134a was used, remove refrigerant using a refrigerant recovery system. If nitrogen was used, relieve the pressure.
- i. Repeat steps f. and g. one time.
- j. Remove the copper tubing and change the filter drier. Evacuate unit to 500 microns. Close the electronic vacuum gauge and vacuum pump valves. Shut off the vacuum pump. Wait five minutes to see if vacuum holds. This procedure checks for residual moisture and/or leaks.
- k. With a vacuum still in the unit, the refrigerant charge may be drawn into the system from a refrigerant container on weight scales.

7.6.4 Partial System

- a. If refrigerant charge has been removed from the low side only, evacuate the low side by connecting the evacuation set-up at the compressor suction valve and the liquid service valve but leave the service valves frontseated until evacuation is completed.
- b. Once evacuation has been completed and the pump has been isolated, fully backseat the service valves to isolate the service connections

and then continue with checking and, if required, adding refrigerant in accordance with normal procedures.

7.7 REFRIGERANT CHARGE

WARNING

EXPLOSION HAZARD Failure to follow this **WARNING** can result in death, serious personal injury and / or property damage.

Never use air or gases containing oxygen (O₂) for leak testing or operating the product.

Charge only with R- 134a: Refrigerant must conform to AHRI Standard 700 specification.

7.7.1 Checking the Refrigerant Charge

NOTE

Use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws. In the U.S.A., refer to EPA Section 608.

- a. Connect the gauge manifold to the compressor discharge and suction service valves. For units operating on a water cooled condenser, change over to air cooled operation.
- b. Bring the container temperature to approximately 0°C (32°F) or below. Then set the controller set point to -25°C (-13°F).
- c. Partially block the condenser coil inlet air. If covering the lower portion of the coil is not sufficient, remove the left hand infill panel and cover the left side of the coil. Increase the area blocked until the compressor discharge pressure is raised to approximately 12.8 bar (185 psig).
- d. On units equipped with a receiver, the level should be between the glasses. On units equipped with a watercooled condenser, the level should be at the center of the glass. If the refrigerant level is not correct, continue with the following paragraphs to add or remove refrigerant as required.

7.7.2 Adding Refrigerant to System (Full Charge)

- a. Evacuate unit and leave in deep vacuum. (Refer to [Section 7.6.1](#).)

- b. Place cylinder of R-134a on scale and connect charging line from cylinder to liquid line valve. Purge charging line at liquid line valve and then note weight of cylinder and refrigerant.
- c. Open liquid valve on cylinder. Open liquid line valve half-way and allow liquid refrigerant to flow into the unit until the correct weight of refrigerant (refer to [Section 3.2](#)) has been added as indicated by scales.

NOTE

It may be necessary to finish charging unit through suction service valve in gas form, due to pressure rise in high side of the system.

- d. Backseat manual liquid line valve (to close off gauge port). Close liquid valve on cylinder.
- e. Start unit in cooling mode. Run for approximately 10 minutes and check the refrigerant charge.

7.7.3 Adding Refrigerant to System (Partial Charge)

- a. Examine refrigerant system for any evidence of leaks, repair as necessary. (Refer to [Section 7.5](#).)
- b. Maintain the conditions outlined in [Section 7.7.1](#).
- c. Fully backseat the suction service valve and remove the service port cap.
- d. Connect charging line between suction service valve port and cylinder of refrigerant R-134a. Open VAPOR valve.
- e. Partially frontseat (turn clockwise) the suction service valve and slowly add charge until the refrigerant appears at the proper level. Be careful not to frontseat the suction valve fully, if the compressor is operated in a vacuum, internal damage may result.

7.8 COMPRESSOR

WARNING

Make sure power to the unit is OFF and power plug disconnected before replacing the compressor.

WARNING

Before disassembly of the compressor, be sure to relieve the internal pressure very carefully by slightly loosening the couplings to break the seal.

! CAUTION

The scroll compressor achieves low suction pressure very quickly. Do not use the compressor to evacuate the system below 0 psig. Never operate the compressor with the suction or discharge service valves closed (frontseated). Internal damage will result from operating the compressor in a deep vacuum.

7.8.1 Removal and Replacement of Compressor

- a. Turn the unit ON and run it in full cool mode for 10 minutes.

NOTE

If the compressor is not operational, frontseat the suction and discharge service valves and go to step e. below.

- b. Frontseat the manual liquid line valve and allow the unit to pull-down to 0.1 kg/cm² (1 psig).
- c. Turn the unit start-stop switch (ST) and unit circuit breaker (CB-1) OFF, and disconnect power to the unit.
- d. Frontseat the discharge and suction service valves.
- e. Remove all remaining refrigerant from the compressor using a refrigerant recovery system.
- f. Remove the compressor terminal cover, disconnect the ground wire and pull the cable plug from the compressor terminals. Install the terminal cover back after removing the power cable.

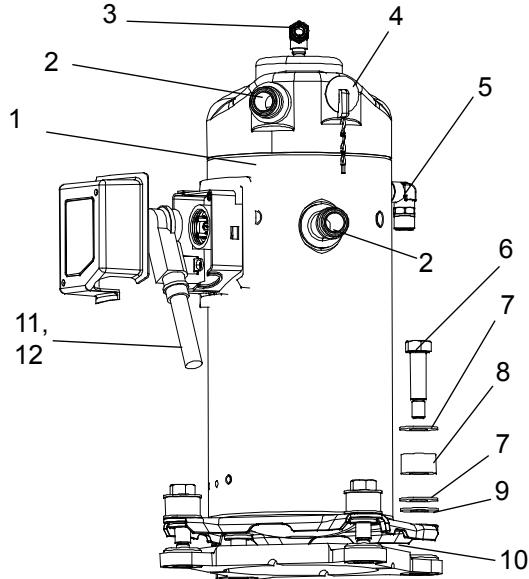
NOTE

Inspect the power cable (plug) terminals to ensure they are not deformed or have any signs of heat or arcing. If any damage is noted, replace the power cable.

- g. Remove the Rotalock fittings from the suction and discharge service connections, and uncouple the unloader and economizer lines from the compressor.
- h. Cut the dome temperature sensor (CPDS) wires. The replacement compressor comes with a CPDS already assembled.
- i. Remove and save the compressor base mounting bolts. Discard the 4 top resilient mounts and washers.
- j. Remove (slide out) the old compressor from the unit.

- k. Inspect compressor base plate for wear. Replace, if necessary.
- l. Wire tie the compressor base plate to the compressor, and slide the new compressor into the unit. (Refer to [Figure 7.5](#)).

Figure 7.5 Compressor Kit



1. Compressor
2. Teflon Seal for Valve Connection (2)
3. O-Ring (Unloader Connection)
4. Compressor Discharge Temperature Sensor
5. O-Ring (Economizer Connection)
6. Base Mounting Bolts
7. SST Washers
8. Resilient Mount
9. Mylar Washers
10. Wire Ties
11. Power Cable Gasket
12. Ground Connection Screw
13. Power Cable Lubricant - Krytox (Not Shown)

NOTE

DO NOT add any oil to the replacement compressor. Replacement compressor is shipped with full oil charge of 60 oz.

- m. Cut and discard the wire ties used to hold the base plate to the compressor.
- n. Place the new SST washers on each side of the resilient mounts, and the new Mylar washer on the bottom of it as shown in [Figure 7.5](#). Install the four base mounting bolts loosely.
- o. Place the new Teflon seals at the compressor suction and discharge ports as well as the O-rings at the unloader and economizer line connection ports. Hand tighten all four connections.

- p. Torque the four base-mounting screws to 6.2 mkg (45 ft-lbs).
- q. Torque the compressor ports / connections to:

Service Valve / Connection	Torque Value
Suction and Discharge Rotalocks	108.5 to 135.5 Nm (80 to 100 ft-lbs.)
Unloader connection	24.5 to 27 Nm (18 to 20 ft-lbs.)
Economized connection	32.5 to 35 Nm (24 to 26 ft-lbs.)

- r. Connect (butt-splice and heat shrink) the new compressor dome temperature sensor with the old sensor wires removed in step h. Wire-tie any loose wiring as appropriate.
- s. Evacuate the compressor to 1000 microns if the unit was pumped down before the replaced compressor was removed. Otherwise, evacuate the complete unit and charge it with R-134a refrigerant (see [Section 7.6.1](#) and [Section 7.7.1](#)).
- t. Open the compressor terminal cover and connect the compressor power cable following the steps below:
 1. Liberally coat the orange gasket surfaces with the Krytox lubricant.
 2. Install the orange gasket part onto the compressor fusite with the grooved or threaded side out. Ensure that the gasket is seated onto the fusite base.
 3. Coat the inside of the power plug (female) connector pins with the Krytox lubricant, and insert the plug onto the compressor terminal connections. Make sure, the orange gasket has bottomed out onto the fusite and it fits securely onto the terminal pins while fully inserted into the orange plug.
 4. Connect the green ground wire to the grounding tab located inside the terminal box of the compressor using the self-tapping grounding screw. Close the compressor terminal box using the terminal cover removed in step t.
 - u. Backseat all service valves, connect the power to the unit and run it for at least 20 minutes.
 - v. Perform a leak check of the system.

7.9 HIGH PRESSURE SWITCH

7.9.1 Checking High Pressure Switch

WARNING

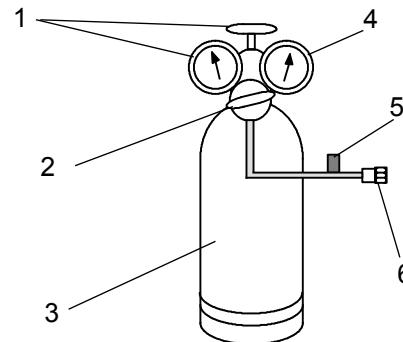
Do not use a nitrogen cylinder without a pressure regulator.

NOTE

The high pressure switch is non-adjustable.

- a. Remove switch as outlined in [Figure 7.9.2](#).
- b. Connect ohmmeter or continuity light across switch terminals. Ohm meter will indicate no resistance or continuity light will be illuminated if the switch closed after relieving compressor pressure.
- c. Connect hose to a cylinder of dry nitrogen. (See [Figure 7.6](#).)

Figure 7.6 High Pressure Switch Testing



1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge (0 to 36 kg/cm² = 0 to 400 psig)
5. Bleed-Off Valve
6. 1/4 inch Connection
- d. Set nitrogen pressure regulator at 26.4 kg/cm² (375 psig) with bleed-off valve closed.
- e. Close valve on cylinder and open bleed-off valve.
- f. Open cylinder valve. Slowly close bleed-off valve to increase pressure on switch. The switch should open at a static pressure up to 25 kg/cm² (350 psig). If a light is used, the light will go out. If an ohmmeter is used, the meter will indicate open circuit.
- g. Slowly open bleed-off valve to decrease the pressure. The switch should close at 18 kg/cm² (250 psig).

7.9.2 Replacing High Pressure Switch

- a. Remove the refrigerant charge.
- b. Disconnect wiring from defective switch. The high pressure switch is located on the discharge connection or line and is removed by turning counterclockwise.
- c. Install a new high pressure switch after verifying switch settings.
- d. Evacuate, dehydrate and recharge the system.
- e. Start the unit, verify refrigeration charge and oil level.

7.10 CONDENSER COIL

The condenser coil consists of a series of parallel copper tubes expanded into copper fins and formed into a "C" shape with the fourth side of the square formed by the side support bracket.

7.10.1 Condenser Coil Cleaning

To ensure optimal efficiency of the unit the condenser coil must be clean. The condenser coil should be cleaned at least once a year, but more frequent cleaning may be required depending on operating conditions. The coil is cleaned with fresh water sprayed in the reverse direction of the air flow to remove any debris from the coil. A high pressure washer is not required, mains water pressure is sufficient. To clean the condenser coil perform the following procedure:

! WARNING

Do not remove the condenser fan grille before turning power OFF and disconnecting the power plug.

- a. Make sure the unit is powered off and the plug is disconnected.
- b. Remove the condenser fan grille.
- c. Starting from the top of the coil, use a water hose with a nozzle to wash the coil from the inside out.
- d. Systematically wash across the inside top face of the coil until the water runs clean.
- e. Wash down the center section, and then through the bottom of the coil, continue washing until the water runs clear.
- f. After the coil is clean, rinse the condenser fan to remove any dirt build up from the blades.
- g. Replace the condenser fan grille ensuring that it is centered around the fan.

7.10.2 Condenser Coil Removal

- a. Using a refrigerant reclaim system remove the refrigerant charge.

! WARNING

Do not remove the condenser fan grille before turning power OFF and disconnecting the power plug.

- b. Remove the condenser fan grille, retain all bolts and washers for reuse.
- c. Remove the condenser fan.
- d. Remove the infill panels to the left and right of the condenser fan shroud.
- e. Remove the condenser fan shroud.
- f. Unplug the condenser fan motor.
- g. Remove and retain sufficient putty from around the motor wire harness to allow the harness to be slid back through the side support bracket.
- h. Cut the top and bottom drain lines midway between the side support bracket and the first cable tie, approx 150mm (6") from the side support bracket.
- i. Remove and retain sufficient putty from around the drain lines to allow the tubes to be slid back through the side support bracket.
- j. Remove filter drier.
- k. Unbraze the inlet connection to coil.
- l. Remove the cushion clamps securing the liquid line to the top and bottom receiver brackets, retain all clamps and securing hardware.
- m. Place a support under the condenser coil before releasing the coil from the frame.
- n. Remove the lower mounting bracket bolts from the inside of the coil.
- o. Remove the top mounting bracket bolts and grille extension mount from inside the coil.
- p. Remove the side support bracket mounting bolts.
- q. Slide the condenser assembly with receiver out of the unit.

7.10.3 Condenser Coil Preparation

Before installing the new condenser coil, the receiver assembly and mounting hardware must be removed from the old coil assembly:

- a. From the old coil, unbolt the receiver assembly from side support bracket.
- b. Unbraz the receiver assembly from the coil outlet line and remove from the coil assembly.
- c. Unbolt the side support bracket from the top and bottom coil supports and remove from old coil.
- d. Refit the side support bracket to the new coil ensuring that the top and bottom are flush mounted with the coil support.

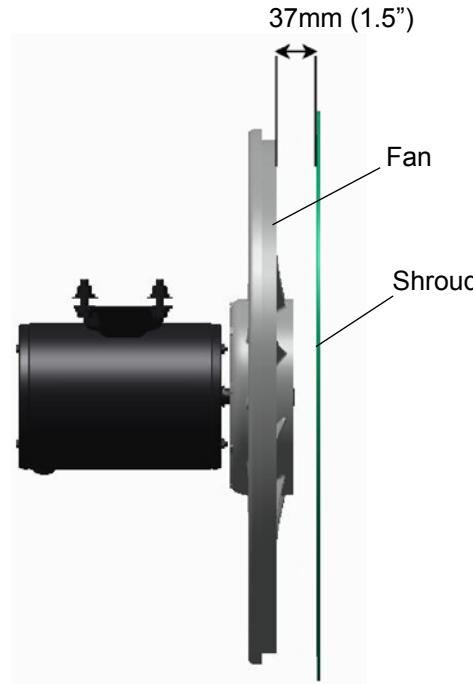
7.10.4 Condenser Coil Installation

Once the side support bracket has been secured to the new condenser coil, the entire assembly is ready to be installed into the unit:

- a. Slide the new condenser coil into place ensuring the coil inlet connection is mated to the pipework and that the coil is fully supported.
- b. Secure the condenser coil into the unit using the retained hardware; refit the mylar and fender washers:
 1. Refit the side support bracket bolts.
 2. Refit the top support bracket bolts as well as the top grille extension support.
 3. Refit the bottom support bracket bolts.
- c. Braze the condenser coil inlet connection.
- d. Insert the receiver pipe work onto the coil outlet and loosely secure the receiver assembly to the side support bracket with the retained hardware.
- e. Braze the outlet connection to the receiver assembly.
- f. Install a new filter drier.
- g. Replace the liquid line cushion clamps.
- h. Secure the receiver assembly to the side support bracket.
- i. Pressure / leak test the coil and filter drier connections, refer to [Section 7.5](#).
- j. Evacuate the entire unit, refer to [Section 7.6](#).
- k. Slide the top and bottom drain lines back into place through the side support bracket.
- l. Using the two supplied straight connectors and contact adhesive reconnect the drain lines.
- m. Slide the condenser fan motor wiring harness back through the side support bracket and refit to condenser motor.
- n. Replace all wire ties that were removed to properly secure the drain line and wiring.

- o. Reseal the wire harness and drain line penetrations with the putty.
- p. Slide the condenser fan onto the motor shaft reversed but do not secure.
- q. Refit the condenser fan shroud to the unit. Use the condenser fan as a guide to ensure the shroud is properly centered around the fan.
- r. Remove the condenser fan, and place it on the shaft facing the correct direction. Adjust the fan to the correct position, 37mm (1.5") from the fan shroud, see [Figure 7.7](#).

Figure 7.7 Condenser Fan Position



- s. Use Loctite "H" on the fan set screws, and tighten.
- t. Refit left and right infill panels.
- u. Refit the condenser fan grille, ensuring the grille is properly centered around the condenser fan.
- v. Evacuate the entire unit, refer to [Section 7.6](#).
- w. Recharge the unit with the charge shown on the unit serial plate, refer to [Section 7.7](#). It is important for proper unit operation that the charge is weighed into the unit.

7.11 CONDENSER FAN AND FAN MOTOR

The condenser fan rotates counter-clockwise (viewed from front of unit). The fan pulls air through the condenser coil, and discharges the air horizontally through the front of the unit.

7.11.1 Condenser Fan Motor Remove/Replace

WARNING

Do not remove the condenser fan grille before turning power OFF and disconnecting the power plug.

- a. Remove the condenser fan grille, retain all bolts and washers for reuse.
- b. Remove the condenser fan by loosening the two set screws.
- c. Disconnect the condenser fan motor wiring.

CAUTION

Take necessary steps (place plywood over coil or use sling on motor) to prevent motor from falling into condenser coil.

- d. Note the number of shims on each side of the motor as the same configuration will be required to refit the new motor.
- e. Remove the fan motor mounting hardware and remove motor.
- f. Loosely mount the new motor using new lock nuts.
- g. Connect the fan motor wiring to the new fan motor.
- h. Replace the shims in the same configuration as they were removed.
- i. Tighten the fan motor mounting bolts to properly secure the motor.
- j. To make sure that the motor is aligned properly, slide the condenser fan onto the motor shaft reversed but do not secure.
- k. Rotate the fan to make sure the fan blades do not contact the shroud:
 1. If the fan motor is misaligned vertically, add or remove shims to align.
 2. If the fan motor is not properly centered, loosen the mounting bolts, and adjust the motor position on the bracket, and then secure the motor.
- l. Remove the condenser fan, and connect the fan motor wiring to the fan motor.

m. Place the condenser fan on the shaft facing the correct direction. Adjust the fan to the correct position, 37mm (1.5") from the fan shroud, see [Figure 7.7](#).

- n. Use Loctite "H" on the fan set screws, and tighten.
- o. Refit the left and right infill panels.
- p. Refit the condenser fan grille, ensuring the grille is properly centered around condenser fan.

7.12 FILTER DRIER

- a. To check filter drier:

1. Test for a restricted or plugged filter drier by feeling the liquid line inlet and outlet connections. If the outlet side feels cooler than the inlet side, then the filter drier should be changed.
2. Check the moisture-liquid indicator if the indicator shows a high level of moisture, the filter drier should be replaced.

- b. To replace filter drier:

1. Pump down the unit (refer to [Section 7.4](#)). Evacuate if unit is not equipped with service valves. Then replace filter drier.
2. Evacuate the low side in accordance with [Section 7.6](#).
3. After unit is in operation, inspect for moisture in system and check charge.

7.13 EVAPORATOR COIL & HEATER ASSEMBLY

The evaporator section, including the evaporator coil, should be cleaned regularly. The preferred cleaning fluid is fresh water or steam. Another recommended cleaner is Oakite 202 or similar, following manufacturer's instructions.

The two drain pan hoses are routed behind the condenser fan motor and compressor. The drain pan line(s) must be open to ensure adequate drainage.

7.13.1 Evaporator Coil Replacement

- a. Pump unit down. (Refer to [Section 7.4](#)).

WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

- b. With power OFF and power plug removed, remove the screws securing the panel covering the evaporator section (upper panel).
- c. Disconnect the defrost heater wiring.
- d. Remove the mounting hardware from the coil.
- e. Unsolder the two coil connections, one at the distributor and the other at the coil header.
- f. Disconnect the defrost temperature sensor (refer to **Section 7.24**) from the coil.
- g. Remove middle coil support.
- h. After defective coil is removed from unit, remove defrost heaters and install on replacement coil.
- i. Install coil assembly by reversing above steps.
- j. Leak check connections. Evacuate and add refrigerant charge.

7.13.2 Evaporator Heater Replacement

The heaters are wired directly back to the contactor and if a heater failure occurs during a trip, the heater set containing that heater may be disconnected at the contactor.

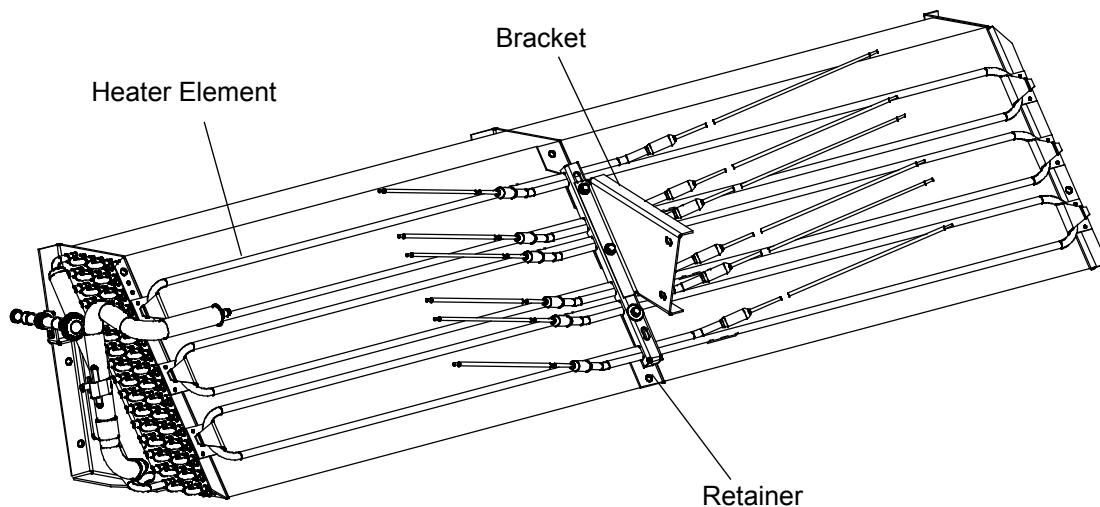
The next Pre-trip (P1) will detect that a heater set has been disconnected and indicate that the failed heater should be replaced. To remove a heater, do the following:

! WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

- a. Before servicing unit, make sure the circuit breakers (CB-1 and CB-2) and start-stop switch (ST) are in the OFF position, and the power plug is disconnected.
 - b. Remove the upper back panel.
 - c. Determine which heater(s) need replacing by checking resistance of each heater set. Refer to **Section 3.3** for heater resistance values. Once the set containing the failed heater is determined, cut the splice connection and retest to determine the actual failed heater(s).
 - d. Remove hold-down clamp securing heater(s) to coil.
 - e. Lift the bent end of the heater (with the opposite end down and away from coil). Move heater to the side enough to clear the heater end support and remove.
- To replace a heater, do steps a through e in reverse.

Figure 7.8 Heater Arrangement



7.14 EVAPORATOR FAN AND MOTOR ASSEMBLY

The evaporator fans circulate air throughout the container by pulling air in the top of the unit. The air is forced through the evaporator coil where it is either

heated or cooled and then discharged out the bottom of the refrigeration unit into the container. The fan motor bearings are factory lubricated and do not require additional grease.

7.14.1 Replacing the Evaporator Fan Assembly

WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

- a. Remove access panel by removing mounting bolts and TIR locking device. Reach inside of unit and remove the Ty-Rap securing the wire harness loop. Disconnect the connector by twisting to unlock and pulling to separate.
- b. Loosen four 1/4-20 clamp bolts that are located on the underside of the fan deck at the sides of the fan assembly. Slide the loosened clamps back from the fan assembly.
- c. Slide the fan assembly out from the unit and place on a sturdy work surface.

7.14.2 Disassemble the Evaporator Fan Assembly

- a. Attach a spanner wrench to the two 1/4-20 holes located in the fan hub. Loosen the 5/8-18 shaft nut by holding the spanner wrench stationary and turning the 5/8-18 nut counter-clockwise (see **Figure 7.9**).
- b. Remove the spanner wrench. Use a universal wheel puller and remove the fan from the shaft. Remove the washers and key.
- c. Remove the four 1/4-20 x 3/4 long bolts that are located under the fan that support the motor and stator housing. Remove the motor and plastic spacer.

7.14.3 Assemble the Evaporator Fan Assembly

- a. Assemble the motor and plastic spacer onto the stator.

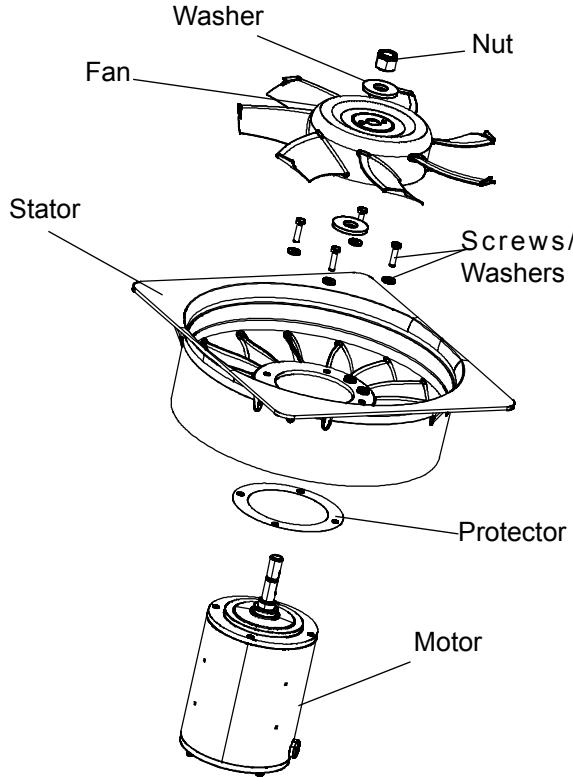
NOTE

When removing the black nylon evaporator fan blade, care must be taken to assure that the blade is not damaged. In the past, it was a common practice to insert a screwdriver between the fan blades to keep it from turning. This practice can no longer be used, as the blade is made up of a material that will be damaged. It is recommended that an impact wrench be used when removing the blade. Do not use the impact wrench when reinstalling, as galling of the stainless steel shaft can occur.

- b. Apply Loctite to the 1/4-20 x 3/4 long bolts and torque to 0.81 mkg (70 inch-pounds).

- c. Place one 5/8 flat washer on the shoulder of the fan motor shaft. Insert the key in the keyway and lubricate the fan motor shaft and threads with a graphite-oil solution (such as Never-seez).
- d. Install the fan onto the motor shaft. Place one 5/8 flat washer with a 5/8-18 locknut onto the motor shaft and torque to 40 foot-pounds.

Figure 7.9 Evaporator Fan Assembly



- e. Install the evaporator fan assembly in reverse order of removal. Torque the four 1/4-20 clamp bolts to 0.81 mkg (70 inch-pounds). Connect the wiring connector.
- f. Replace access the panel making sure that the panel does not leak. Make sure that the TIR locking device is lockwired.

7.15 EVAPORATOR SECTION CLEANING

Containers and Container units that are exposed to certain fumigants may develop visible surface corrosion. This corrosion will show up as a white powder found on the inside of the container and on the reefer unit evaporator stator and fan deck.

Analyses by Carrier Transicold environmental specialists have identified the white powder as consisting predominantly of aluminum oxide. Aluminum oxide is a coarse crystalline deposit most likely the result of surface corrosion on the aluminum parts within the container. If left untreated over time, it may build up in thickness and eventually flake as a light-weight white powder.

The surface corrosion of aluminum is brought about by exposure to chemicals such as sulfur dioxide and possibly other fumigants that are commonly used for fumigation and protection of some perishable cargo such as grapes, for example. Fumigation is the process by which a chemical is released into an enclosed area to eliminate infestations of insects, termites, rodents, weeds and soil-born disease.

Typically any aluminum oxide that becomes detached from evaporator fan stators will be blown into the wet evaporator coil where it will be caught and then flushed out of the unit during routine defrost cycles.

However, it is still highly recommended that after carrying cargo subject to fumigation procedures, that the inside of the unit be thoroughly cleansed prior to reuse.

Carrier Transicold has identified a fully biodegradable and environmentally safe alkaline cleaning agent (Tri-Pow'r® HD) for the unit. This will assist in helping to remove the corrosive fumigation chemicals and dislodging of the corrosive elements.

This cleaner is available from the Carrier Transicold Performance Parts Group (PPG) and can be ordered through any of the PPG locations; Part Number NU4371-88.

As a general safety precaution, before using this product, refer to and retain the Material Safety Data (MSDS) sheet. This document can be found at:

www.nucalgon.com/products/coil_cleaners_tripower.htm

Prior to Cleaning:

- Always wear goggles, gloves and work boots.
- Avoid contact with skin and clothing, and avoid breathing mists.
- When mixing, add water to the sprayer first, then the cleaner.
- ALWAYS provide for proper ventilation when cleaning indoor evaporator coils (rear doors must be open).
- Be aware of surroundings - food, plants, etc., and the potential for human exposure.
- Always read directions and follow recommended dilution ratios. More is not always better. Using non-diluted cleaner is not recommended.

Cleaning Procedure:

- a. Remove the upper evaporator access panel inside of the unit.
- b. Spray the surface with water before applying the cleaning solution. This helps the cleaner work better.
- c. Liberally apply the prepared cleaner solution (5 parts water and 1 part cleaner).

- d. Allow the cleaner to soak in for 5 to 7 minutes.
- e. Assess area for rinsing. Follow all local regulations regarding disposal of waste water.
- f. Thoroughly rinse the cleaner and surrounding area, floor, etc. When rinsing where heavy foaming solution is present, it is very important to take the time to thoroughly rinse the equipment and surroundings.
- g. Always rinse the empty coil cleaner bottle, cap tightly and dispose of properly.

7.16 ELECTRONIC EXPANSION VALVE

The electronic expansion valve (EEV) is an automatic device which maintains required superheat of the refrigerant gas leaving the evaporator. The valve functions are: (a) automatic response of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance

7.16.1 Replacing Electronic Expansion Valve and Strainer

- a. Removing an EEV:

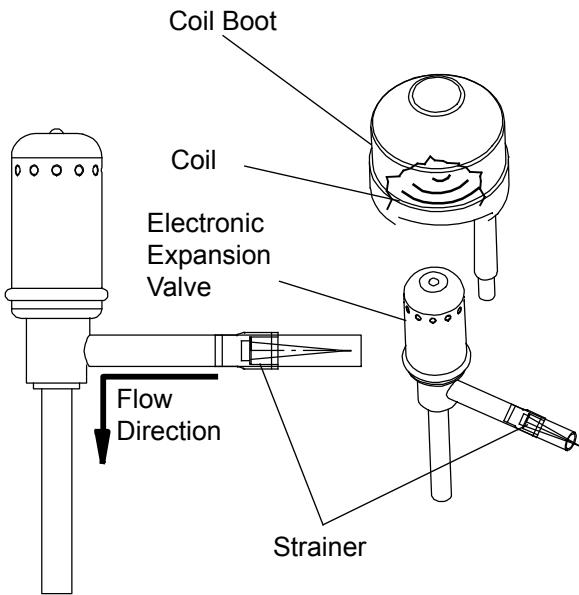
! WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

1. Pump down the compressor (refer to [Section 7.4](#)) and frontseat both suction and discharge valves.
2. Turn unit power off and remove power from the unit.
3. Remove coil.
4. VALVE REMOVAL: The preferred method of removing the valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove valve. Alternately, use a wet rag to keep valve cool. Heat inlet and outlet connections to valve body and remove valve.
5. Clean the valve stem with mild cleaner, if necessary.
- b. Installing an EEV; Reverse steps 1 through 4 above to install a new valve.
1. Install the valve and a new strainer with the cone of strainer / screen pointing into liquid line at the inlet to the valve.

- During installation, make sure the EEV coil is snapped down fully, and the coil retention tab is properly seated in one of the valve body dimples. Also, ensure that coil boot is properly fitted over valve body. See **Figure 7.10**.

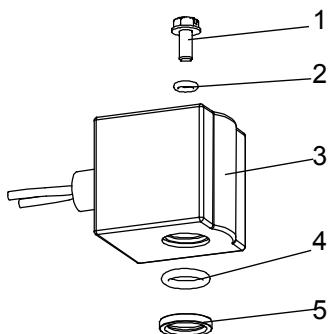
Figure 7.10 Electronic Expansion Valve



- Replace filter drier.
- Evacuate to 500 microns by placing vacuum pump on liquid line and suction service valve.
- Open liquid line service valve and check refrigerant level.
- Check superheat. (Refer to **Section 3.2**).
- Check unit operation by running Pre-trip (Refer to **Section 4.8**).

7.17 ECONOMIZER SOLENOID VALVE

Figure 7.11 Coil View of Economizer Solenoid Valve (ESV)



- Slotted Screw
- Top Coil (small) O-ring
- Solenoid Coil, Enclosing Tube and Body
- Bottom Coil (large) O-ring

5. Brass Spacer

- Removing a Solenoid Valve Coil:

WARNING

Always turn OFF the unit circuit breakers (CB-1 & CB-2) and disconnect main power supply before working on moving parts.

- Turn unit power off and remove power from the unit. Disconnect leads.
- Remove top screw and o-ring. Remove coil and save mounting hardware, seals and spacer for reuse. (See **Figure 7.11**). Refer to step d. for valve coil replacement.
- Removing the Solenoid Valve:
 - Pump down the compressor (refer to **Section 7.4**) and frontseat both suction and discharge valves.
 - VALVE REMOVAL:** The preferred method of removing the solenoid valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove valve. Alternately, heat inlet and outlet connections to valve body and remove valve.
 - Clean the valve stem with mild cleaner, if necessary.
- Installing the Solenoid Valve:
 - Fit the new solenoid valve into position and braze. Use a wet rag to keep valve cool whenever brazing.
- Installing the Solenoid Valve Coil:
 - Install the brass spacer on the valve stem.
 - Lubricate both o-rings with silicone provided in the kit.
 - Install bottom coil o-ring on the valve stem.
 - Install the solenoid coil on the valve stem.
 - Place the top coil o-ring on the coil mounting screw and secure the coil to the valve using a torque wrench. Torque the screw to 25 in-lbs.
 - Connect coil wires using butt-splices and heat shrink tubing.

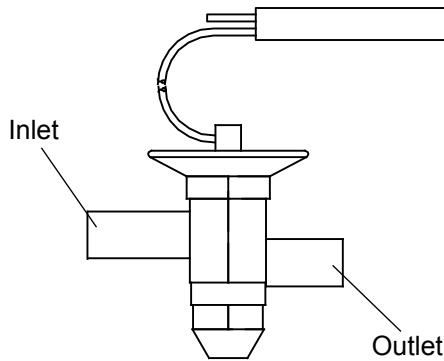
7.18 ECONOMIZER EXPANSION VALVE

The economizer expansion valve is an automatic device that maintains constant superheat of the refrigerant gas leaving at the point of bulb attachment, regardless of suction pressure.

Unless the valve is defective, it seldom requires maintenance other than periodic inspection to ensure that the thermal bulb is tightly secured to the suction line and wrapped with insulating compound.

7.18.1 Economizer Expansion Replacement

Figure 7.12 Economizer Expansion Valve



- Removing the Economizer Expansion Valve:

NOTE

The economizer expansion valve is a hermetic valve, it does not have adjustable superheat (See **Figure 7.12**).

- Pump down the compressor (refer to **Section 7.4**) and frontseat both suction and discharge valves. Evacuate if unit is not equipped with service valves. Refer to **Section 7.6.1**.
- Turn unit power off and remove power from the unit.
- Remove cushion clamps located on the inlet and outlet lines.
- Remove insulation (Presstite) from expansion valve bulb.
- Unstrap the bulb, located on the economizer line.
- VALVE REMOVAL:** The preferred method of removing the valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove valve. Alternately, use a wet rag to keep valve cool. Heat inlet and outlet connections to valve body and remove valve.
- Clean the valve stem with mild cleaner, if necessary.
- Installing the Economizer Expansion Valve:**
 - The economizer expansion valve should be wrapped in a soaked cloth for brazing.
 - Braze inlet connection to inlet line.

- Braze outlet connection to outlet line.
- Reinstall the cushion clamps on inlet and outlet lines.
- Replace filter drier, (Refer to **Section 7.12**).
- Evacuate to 500 microns by placing vacuum pump on liquid line and suction service valve.
- Check economizer expansion valve superheat (see **Section 3.2**).

7.19 TROUBLESHOOTING P6-7 (DUV)

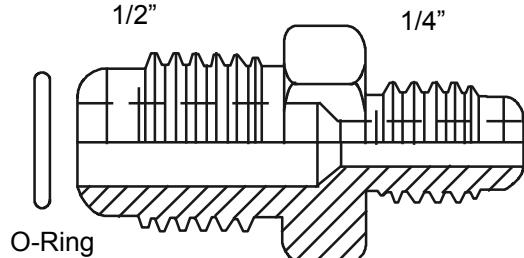
A failed digital unloader valve (DUV), which is normally closed, or an internal seal failure of the compressor can result in the unit running continually in the fully loaded mode causing it to undershoot its set point temperature.

Both of these can be checked out by running pre-trip test P6-7. When running P6-7, the controller is looking for the differences in pressure and current draw between loaded mode and unloaded mode to make a judgment. If there are no differences, then it will show fail.

To confirm what caused the test to fail, perform the following additional test.

- Connect manifold gauge set to discharge (DSV) and suction (SSV) service valves.
- Front seat the SSV and pump down the compressor.
- Front seat the DSV valve to isolate the compressor.
- Disconnect DUV from the top of compressor and install a 1/2 to 1/4 flared adapter / O-ring (pn 40-50076-00sv).

Figure 7.13 Adapter and O-Ring



- Using R134a or Nitrogen, pressurize the line to 50 psi (3.5 bar) at the adapter connection and close supply at the tank. Pressure should hold as the valve is normally closed. If pressure drops, check for leaks at the installed fitting (40-50076-00sv); repair and retest. If pressure increases at the suction service valve and

decreases at the pressure supply; the valve is leaking and should be replaced. If no leak proceed to step 6.

6. Energize DUV by removing coil and placing a magnet on the valve stem opening the valve. If the pressure does not increase at the SSV and decrease at the supply, replace the valve as it did not open.

If a magnet is not available, a jumper procedure can be used as follows:

1. Remove all 4 controller fuses (F1, F2, F3a, F3b).
2. Remove the KA6 wire from KA controller connector on the front of the controller.
3. Disconnect the X1 wire from the 24VAC side of transformer (black wire) and locate it away from the transformer.
4. Jumper between the black transformer wires to the KA6 wire removed from the connector.
5. Connect power to unit and turn circuit breaker on (DUV coil is now energized).
6. Pressure should drop.
7. Power circuit breaker off, reconnect wires and reinstall fuses.

If the valve opens and closes properly, the failure mode is with the compressor and it should be changed at the earliest opportunity.

7.20 DIGITAL UNLOADER VALVE

- a. Removing the DUV:

1. Pump down the compressor (refer to [Section 7.4](#)) and frontseat both suction and discharge valves. In the event the DUV is stuck open and compressor cannot pump down, remove charge.

! CAUTION

The scroll compressor achieves low suction pressure very quickly. Do not use the compressor to evacuate the system below 0 psig. Never operate the compressor with the suction or discharge service valves closed (frontseated). Internal damage will result from operating the compressor in a deep vacuum.

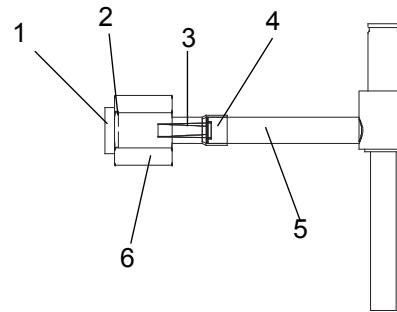
2. Turn unit power off and remove power from the unit.
3. Loosen bolt on top of the DUV and remove coil assembly.

NOTE

There is a small spacer tube between the top of the valve and the 12 VDC coil that needs to be reinstalled into the solenoid valve coil. When removing the coil, it may fall out when lifted from the valve body. Take care that the spacer is not lost; the valve will not function correctly without it.

4. Remove clamps holding the DUV to the discharge line.
5. Loosen the nuts attaching the DUV to the top of the compressor.
6. VALVE REMOVAL: The preferred method of removing the solenoid valve is to cut the connection between the brazed section and the valve, using a small tube cutter. Remove valve. (See [Figure 7.14](#)).
Alternately, use a wet rag to keep valve cool. Heat outlet connection to valve body and remove valve.

Figure 7.14 View of Digital Unloader Valve (DUV) Assembly



1. Sleeve
2. O-ring (hidden)
3. Screen Valve Strainer
4. Tube
5. Solenoid Valve Body
6. Hex Nut, 1/2 OD
7. Examine compressor and service valves. Ensure that the o-ring is not stuck in the gland of the valve.
8. Discard the o-ring on the o-ring face seal connection.
- b. Installing the DUV:
 1. Lubricate the gland shoulder area and o-ring with refrigerant oil.
 2. Fit new valve in position and hand-tighten the o-ring nut.
 3. Use a wet rag to keep valve cool while brazing. Braze DUV to service valve connection.

4. Reinstall and tighten the brackets that secure the valve body to the discharge line.
5. Torque o- ring face seal connections to 18 to 20 ft-lbs.
6. Install the coil onto the valve body and tighten the attachment bolt.

NOTE

Confirm that the small spacer tube is inserted into the coil prior to attaching it to the valve body. The valve will not function correctly without it.

7. Leak check and evacuate low side of unit as applicable. Refer to [Section 7.6.1](#).
8. Open service valves.

7.21 VALVE OVERRIDE CONTROLS

Controller function code Cd41 is a configurable code that allows timed operation of the automatic valves for troubleshooting. Test sequences are provided in [Table 7-1](#). Capacity mode (CAP) allows alignment of the economizer solenoid valve in the standard and economized operating configurations. DUV Capacity Modulation, % Setting (PCnt) and Electronic Expansion Valve (EEV) allows opening of the digital unloader valve and electronic expansion valve, respectively, to various percentages. If the unit is equipped with an LIV, the Liquid Valve Setting allows the LIV to be automatically controlled, or manually opened and closed.

The Override Timer (tIM) selection is also provided to enter a time period of up to five minutes, during which the override(s) are active. If the timer is active, valve override selections will take place immediately. If the timer is not active, changes will not take place for a few seconds after the timer is started. When the timer times out, the override function is automatically terminated and the valves return to normal machinery control. To operate the override:

- a. Press the CODE SELECT key then press an ARROW key until Cd41 is displayed in the left window. The right window will display a controller communications code.
- b. Press the ENTER key. The left display will show a test name alternating with the test setting or time remaining. Use an ARROW key to scroll to the desired test. Press the ENTER key, SELCt will appear in the left display.
- c. Use an ARROW key to scroll to the desired setting, and then press the ENTER key. Selections available for each of the tests are provided in [Table 7-1](#).
- d. If the timer is not operating, follow the above procedure to display the timer. Use an ARROW key to scroll to the desired time interval and press ENTER to start the timer.
- e. The above described sequence may be repeated during the timer cycle to change to another override

Table 7–1 Valve Override Control Displays

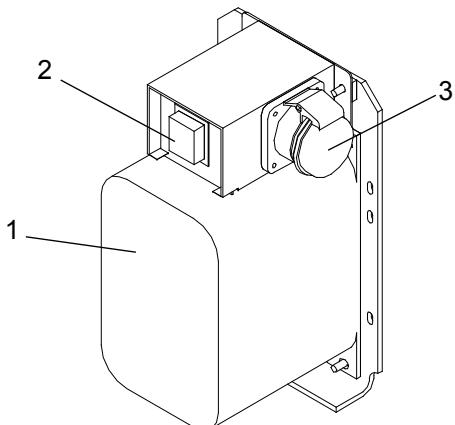
Left Display	Controller Communications Codes (Right Display)	Setting Codes (Right Display)
Cd 41/SELct	tIM (Override Timer)	0 00 (0 minutes/0 Seconds) In 30 second increments to 5 00 (5 minutes/ 0 seconds)
	PCnt (% Setting - DUV Capacity Modulation)	AUto (Normal Machinery Control) 0 3 6 10 25 50 100
	EEV (% Setting - Electronic Expansion Valve)	AUto (Normal Machinery Control) CLOSE (Closed) 0 3 6 10 25 50 100
	CAP (Capacity Mode)	AUto (Normal Control) Std UnLd (Economizer = Closed) ECOn (Economizer = Open)

7.22 AUTOTRANSFORMER

If the unit does not start, check the following:

- Make sure the 460 VAC (yellow) power cable is plugged into the receptacle (see [Figure 7.15](#)) and locked in place.
- Make sure that circuit breakers CB-1 and CB-2 are in the “ON” position. If the circuit breakers do not hold in, check voltage supply.
- There is no internal protector for this transformer design, therefore, no checking of the internal protector is required.
- Using a voltmeter, and with the primary supply circuit ON, check the primary (input) voltage (460 VAC). Next, check the secondary (output) voltage (230 VAC). The transformer is defective if output voltage is not available.

Figure 7.15 Autotransformer



- Dual Voltage Modular Autotransformer
- Circuit Breaker (CB- 2) 230- Volt
- 460 VAC Power Receptacle

7.23 CONTROLLER

7.23.1 Handling Modules

! CAUTION

Do not remove wire harnesses from module unless you are grounded to the unit frame with a static safe wrist strap.

! CAUTION

Unplug all module connectors before performing arc welding on any part of the container.

The guidelines and cautions provided herein should be followed when handling the modules. These precautions and procedures should be implemented when replacing a module, when doing any arc welding on the unit, or when service to the refrigeration unit requires handling and removal of a module.

- a. Obtain a grounding wrist strap (Carrier Transicold P/N 07-00304-00) and a static dissipation mat (Carrier Transicold P/N 07-00277-00). The wrist strap, when properly grounded, will dissipate any potential static buildup on the body. The dissipation mat will provide a static-free work surface on which to place and/or service the modules.
- b. Disconnect and secure power to the unit.
- c. Place strap on wrist and attach the ground end to any exposed unpainted metal area on the refrigeration unit frame (bolts, screws, etc.).
- d. Carefully remove the module. Do not touch any of the electrical connections if possible. Place the module on the static mat.
- e. The strap should be worn during any service work on a module, even when it is placed on the mat.

7.23.2 Controller Troubleshooting

A group of test points (TP, see **Figure 7.16**) are provided on the controller for troubleshooting electrical circuits (see schematic diagram, section 7). A description of the test points follows:

NOTE

Use a digital voltmeter to measure AC voltage between TP's and ground (TP9), except for TP8.

TP 1 - Not used in this application.

TP 2 - Enables the user to check if the high pressure switch (HPS) is open or closed.

TP 3 - Enables the user to check if the water pressure switch (WP) contact is open or closed.

TP 4 - Enables the user to check if the internal protector for the condenser fan motor (IP-CM) is open or closed.

TP 5 - Enables the user to check if the internal protectors for the evaporator fan motors (IP-EM1 or IP-EM2) are open or closed.

TP 6 (IF EQUIPPED) - Enables the user to check if the controller liquid injection valve relay (TQ) is open or closed.

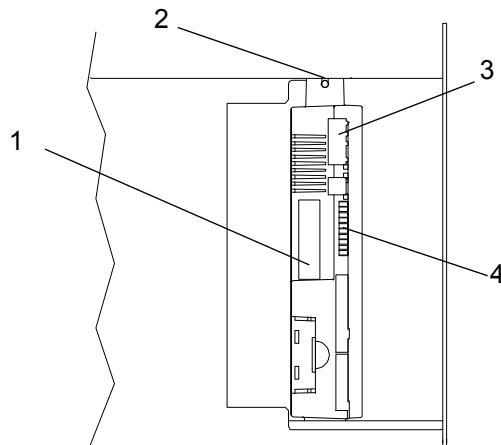
TP 7 - Enables the user to check if the controller economizer solenoid valve relay (TS) is open or closed.

TP 8 - Not used in this application.

TP 9 - The chassis (unit frame) ground connection.

TP 10 - Enables the user to check if the heat termination thermostat (HTT) contact is open or closed.

Figure 7.16 Controller Section of the Control Box



1. Controller Software Programming Port
2. Mounting Screw
3. Controller
4. Test Points

7.23.3 Controller Programming Procedure

! CAUTION

The unit must be OFF whenever a programming card is inserted or removed from the controller programming port.

1. Turn unit OFF, via start-stop switch (ST).
2. Insert software/programming PCMCIA card containing the following (example) files into the programming/software port. (See **Figure 7.16**):
menuDDMM.m/3, this file allows the user to select a file/program to upload into the controller.
cfYYMMDD.m/3, multi-configuration file.

3. Turn unit ON, via start-stop switch (ST).

Programming Procedure for Software Versions 5354 and Greater & With Updated Menu Option (menu0115.m1)

NOTE

Units must be loaded with software version 5354 or higher. See the label in the control box door for factory installed software version.

The updated menu option allows the operational software to be loaded, and time and container identification to be set.

a. Procedure for loading Operational Software:

1. The display module will display the message SETUP.
2. Press the UP or DOWN arrow key until the display reads, LOAd 53XX for Scroll.
3. Press the ENTER key on the keypad.
4. The display will alternate to between PrESS EntR and rEV XXXX.
5. Press the ENTER key on the keypad.
6. The display will show the message "Pro SoFt". This message will last for up to one minute.
7. The display module will go blank briefly, then read "Pro donE" when the software loading has loaded. (If a problem occurs while loading the software: the display will blink the message "Pro FAIL" or "bad 12V." Turn start-stop switch OFF and remove the card.)
8. Turn unit OFF, via start-stop switch (ST).
9. Remove the PCMCIA card from the programming/software port and return the unit to normal operation by placing the start-stop switch in the ON position.
10. Turn power on and wait about 15 seconds for the new software to load into the controller memory. The status LED will flash quickly and the display will remain blank as the controller loads the new software. When complete, the controller will reset and power up normally.
11. Wait for default display, setpoint on the left, and control temperature on the right.
12. Confirm software is correct using keypad code select 18 to view Cd18 XXXX.
13. Turn power off. Operational software is loaded.

b. Procedure for loading Configuration Software:

1. Turn unit OFF using start-stop switch (ST).

2. Insert software/programming PCMCIA card containing the following (example) files into the programming/software port. (See **Figure 7.16**): menuDDMM.m13, this file allows the user to select the file/program to upload into the controller.
cfYYMMDD.m13, multi-configuration file.
3. Turn unit ON using start-stop switch (ST).
4. Press the UP or DOWN arrow key until display reads Set UP.
5. Press the ENTER key on the keypad.
6. Press the UP or DOWN arrow key until display reads XXXX the message ruN COnFG. (If a defective card is being used the display will blink the message "bAd CArD." Turn start-stop switch OFF and remove the card.)
7. Press the ENTER key on the keypad.
8. The display module will go blank briefly and then display "551 00", based on the operational software installed.
9. Press the UP or DOWN ARROW key to scroll through the list to obtain the proper model dash number. (If a defective card is being used, the display will blink the message "bAd CArD." Turn start-stop switch OFF and remove the card.)
10. Press the ENTER key on the keypad.
11. When software loading has successfully completed, the display will show the message "EEPrM donE." (If a problem occurs while loading the software, the display will blink the message "Pro FAIL" or "bad 12V." Turn start-stop switch OFF and remove the card.)
12. Turn unit OFF using start-stop switch (ST).
13. Remove the PCMCIA card from the programming/software port and return the unit to normal operation by placing the start-stop switch in the ON position.
14. Confirm correct model configuration using the keypad to choose code 20 (CD20). The model displayed should match the unit serial number plate.

c. Procedure for setting the date and time:

1. Press the UP or DOWN arrow key until display reads Set TIM.
2. Press the ENTER key on the keypad.
3. The first value to be modified is the date in YYYY MM- DD format. The values will be entered from right to left. Press the UP or DOWN ARROW key to increase or decrease

the values. The ENTER key will enter the information for the current field and move to the next value; the CODE SELECT key will allow modification of the previous value.

4. Press the ENTER key on the keypad.
5. The next value to be modified is the time in HH MM format. The values will be entered from right to left. Press the UP or DOWN ARROW key to increase or decrease the values. The ENTER key will enter the information for the current field and move to the next value; the CODE SELECT key will allow modification of the previous value.
6. Press the ENTER key on the keypad. The date and time will not be committed until start up procedures are completed on the next power up.

d. Procedure for setting the container ID:

NOTE

The characters will be preset to the container ID already on the controller. If none exist, the default will be AAAA0000000.

1. Press the UP or DOWN arrow key until display reads Set ID.
2. Press the ENTER key on the keypad.
3. Values will be entered from right to left. Press the UP or DOWN ARROW key to increase or decrease the values. ENTER will enter the information for the current field and move to the next value; CODE SELECT will allow modification of the previous value.
4. When the last value is entered, press the ENTER key to enter the information to the controller; the CODE SELECT key will allow modification of the previous value.

7.23.4 Removing and Installing a Controller

a. Removal:

1. Disconnect all front wire harness connectors and move wiring out of way.
2. The lower controller mounting is slotted, loosen the top mounting screw (see **Figure 7.16**) and lift up and out.
3. Disconnect the back connectors and remove module.
4. When removing the replacement module from its packaging, note how it is packaged. When returning the old module for service, place it in the packaging in the same manner as the replacement. The packaging has been designed

to protect the module from both physical and electrostatic discharge damage during storage and transit.

b. Installation:

Install the module by reversing the removal steps.

Torque values for mounting screws (item 2, see **Figure 7.16**) are 0.23 mkg (20 inch-pounds). Torque value for the connectors is 0.12 mkg (10 inch-pounds).

7.23.5 Battery Replacement

Standard Battery Location (Standard Cells):

- a. Turn unit power OFF and disconnect power supply.
- b. Slide bracket out and remove old batteries. (See **Figure 4.4**, Item 8.)
- c. Install new batteries and slide bracket into control box slot.

CAUTION

Use care when cutting wire ties to avoid nicking or cutting wires.

Standard Battery Location (Rechargeable Cells):

- a. Turn unit power OFF and disconnect power supply.
- b. Disconnect battery wire connector from control box.
- c. Slide out and remove old battery and bracket. (See **Figure 4.4**, Item 8.)
- d. Slide new battery pack and bracket into the control box slot.
- e. Reconnect battery wire connector to control box and replace wire ties that were removed.

Secure Battery Option (Rechargeable Cells Only):

- a. Turn unit power OFF and disconnect power supply.
- b. Open control box door and remove both the high voltage shield and clear plastic rain shield (if installed).
- c. Disconnect the battery wires from the "KA" plug positions 14, 13, 11.
- d. Using Driver Bit, Carrier Transicold part number 07- 00418- 00, remove the 4 screws securing the display module to the control box. Disconnect the ribbon cable and set the display module aside.

NOTE

The battery wires must face toward the right.

- e. Remove the old battery from the bracket and clean bracket surface. Remove the protective backing from the new battery and assemble to the bracket. Secure battery by inserting the wire tie from the back of the bracket around the battery, and back through the bracket.
- f. Reconnect the ribbon cable to display and reinstall the display.
- g. Route the battery wires from the battery along the display harness and connect the red battery wire and one end of the red jumper to "KA14," the other end of the red jumper wire to "KA11," and the black wire to "KA13."
- h. Replace wire ties that were removed.

7.24 TEMPERATURE SENSOR SERVICE

Service procedures for the return recorder, return temperature, supply recorder, supply temperature, ambient, defrost temperature, evaporator temperature, and compressor discharge temperature sensors are provided in the following sub paragraphs.

7.24.1 Sensor Checkout Procedure

To verify that accuracy of a temperature sensor:

- a. Remove the sensor and place in a 0°C (32°F) ice-water bath. The ice-water bath is prepared by filling an insulated container (of sufficient size to completely immerse bulb) with ice cubes or chipped ice, then filling voids between ice with water and agitating until mixture reaches 0°C (32°F) measured on a laboratory thermometer.
- b. Start unit and check sensor reading on the control panel. The reading should be 0°C (32°F). If the reading is correct, reinstall sensor; if it is not, continue with the following.
- c. Turn unit OFF and disconnect power supply.
- d. Refer to **Section 7.23** and remove controller to gain access to the sensor plugs.
- e. Using the plug connector marked "EC" that is connected to the back of the controller, locate the sensor wires (RRS, RTS, SRS, STS, AMBS, DTS, or CPDS as required). Follow those wires to the connector and using the pins of the plug, measure the resistance. Values are provided in **Table 7–2** and **Table 7–3**.

Due to the variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within 2% of the chart value would indicate a good sensor. If a sensor is defective, the resistance reading will usually be much higher or lower than the resistance values given.

Table 7–2 Sensor Resistance

Sensors AMBS, DTS, ETS, RRS, RTS, SRS, STS											
°C	°F	Ohms	°C	°F	Ohms	°C	°F	Ohms	°C	°F	Ohms
-40	-40	336,500	-7.8	18	49,060	24.4	76	10,250	56.7	134	2,809
-38.9	-38	312,600	-6.7	20	46,230	25.6	78	9,760	57.8	136	2,697
-37.8	-36	290,600	-5.6	22	43,580	26.7	80	9,299	58.9	138	2,590
-36.7	-34	270,300	-4.4	24	41,100	27.8	82	8,862	60.0	140	2,488
-35.6	-32	251,500	-3.3	26	38,780	28.9	84	8,449	61.1	142	2,390
-34.4	-30	234,200	-2.2	28	36,600	30.0	86	8,057	62.2	144	2,297
-33.3	-28	218,200	-1.1	30	34,560	31.1	88	7,686	63.3	146	2,208
-32.2	-26	203,400	0	32	32,650	32.2	90	7,334	64.4	148	2,124
-31.1	-24	189,700	1.1	34	30,850	33.3	92	7,000	65.6	150	2,042
-30	-22	177,000	2.2	36	29,170	34.4	94	6,684	68.3	155	1,855
-28.9	-20	165,200	3.3	38	27,590	35.6	96	6,384	71.1	160	1,687
-27.8	-18	154,300	4.4	40	26,100	36.7	98	6,099	73.9	165	1,537
-26.7	-16	144,200	5.5	42	24,700	37.8	100	5,828	76.7	170	1,402
-25.6	-14	134,800	6.6	44	23,390	38.9	102	5,571	79.4	175	1,281
-24.4	-12	126,100	7.7	46	22,160	40.0	104	5,327	82.2	180	1,171
-23.3	-10	118,100	8.9	48	20,990	41.1	106	5,095	85.0	185	1,072
-22.2	-8	110,500	10	50	19,900	42.2	108	4,874	87.8	190	983
-21.1	-6	103,600	11.1	52	18,870	43.3	110	4,665	90.6	195	902
-20	-4	97,070	12.2	54	17,900	44.4	112	4,465	93.3	200	829
-18.9	-2	91,030	13.3	56	16,980	45.5	114	4,275	96.1	205	762
-17.8	0	85,400	14.4	58	16,120	46.7	116	4,095	98.9	210	702
-16.7	2	80,160	15.5	60	15,310	47.8	118	3,923	101.7	215	647
-15.6	4	75,270	16.6	62	14,540	48.9	120	3,759	104.4	220	598
-14.4	6	70,720	17.7	64	13,820	50.0	122	3,603	107.2	225	553
-13.3	8	66,460	18.9	66	13,130	51.1	124	3,454	110.0	230	511
-12.2	10	62,500	20.0	68	12,490	52.2	126	3,313	112.8	235	473
-11.1	12	58,790	21.1	70	11,880	53.3	128	3,177	115.6	240	438
-10.0	14	55,330	22.2	72	11,310	54.4	130	3,049	118.3	245	406
-8.9	16	52,090	23.3	74	10,760	55.6	132	2,926	121.1	250	378

Table 7-3 Sensor Resistance (CPDS)

°C	°F	Ohms	°C	°F	Ohms	°C	°F	Ohms
-40	-40	2,889,600	38	100.4	49,656	116	240.8	3,759
-38	-36.4	2,532,872	40	104.0	45,812	118	244.4	3,550
-36	-32.8	2,225,078	42	107.6	42,294	120	248.0	3,354
-34	-29.2	1,957,446	44	111.2	39,078	122	251.6	3,173
-32	-25.6	1,724,386	46	114.8	36,145	124	255.2	3,004
-30	-22.0	1,522,200	48	118.4	33,445	126	258.8	2,850
-28	-18.4	1,345,074	50	122.0	30,985	128	262.4	2,711
-26	-14.8	1,190,945	52	125.6	28,724	130	266.0	2,580
-24	-11.2	1,056,140	54	129.2	26,651	132	269.6	2,454
-22	-7.6	938,045	56	132.8	27,750	134	273.2	2,335
-20	-4.0	834,716	58	136.4	23,005	136	276.8	2,223
-18	-0.4	743,581	60	140.0	21,396	138	280.4	2,119
-16	3.2	663,593	62	143.6	19,909	140	284.0	2,021
-14	6.8	593,030	64	147.2	18,550	142	287.6	1,928
-12	10.4	530,714	66	150.8	17,294	144	291.2	1,839
-10	14.0	475,743	68	154.4	16,133	146	294.8	1,753
-8	17.6	426,904	70	158.0	15,067	148	298.4	1,670
-6	21.2	383,706	72	161.6	14,078	150	302.0	1,591
-4	24.8	345,315	74	165.2	13,158	152	305.6	1,508
-2	28.4	311,165	76	168.8	12,306	154	309.2	1,430
0	32.0	280,824	78	172.4	11,524	156	312.8	1,362
2	35.6	253,682	80	176.0	10,793	158	316.4	1,302
4	39.2	229,499	82	179.6	10,122	160	320.0	1,247
6	42.8	207,870	84	183.2	9,494	162	323.6	1,193
8	46.4	188,494	86	186.8	8,918	164	327.2	1,142
10	50.0	171,165	88	190.4	8,376	166	330.8	1,096
12	53.6	155,574	90	194.0	7,869	168	334.4	1,054
14	57.2	141,590	92	197.6	7,404	170	338.0	1,014
16	60.8	129,000	94	201.2	6,972	172	341.6	975
18	64.4	117,656	96	204.8	6,571	174	345.2	938
20	68.0	107,439	98	208.4	6,197	176	348.8	902
22	71.6	98,194	100	212.0	5,848	178	352.4	867
24	75.2	89,916	102	215.6	5,529	180	356.0	834
26	78.8	82,310	104	219.2	5,233	182	359.6	798
28	82.4	75,473	106	222.8	4,953	184	363.2	764
30	83.0	69,281	108	226.4	4,692	186	366.8	733
32	89.6	63,648	110	230.0	4,446	188	370.4	706
34	93.2	58,531	112	233.6	4,204	190	374.0	697
36	96.8	53,887	114	237.2	3,977			

7.24.2 Sensor Replacement

⚠️ WARNING

Always turn OFF the unit circuit breaker (CB-1) and disconnect main power supply before removing electrical parts.

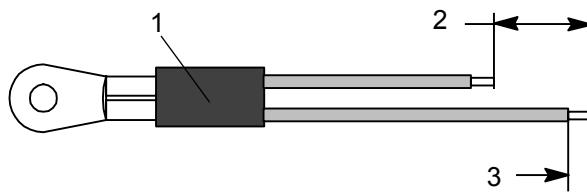
- Turn unit power OFF and disconnect power supply.

NOTE

Include white date code label when cutting out and removing defective sensors. The label could be required for warranty returns.

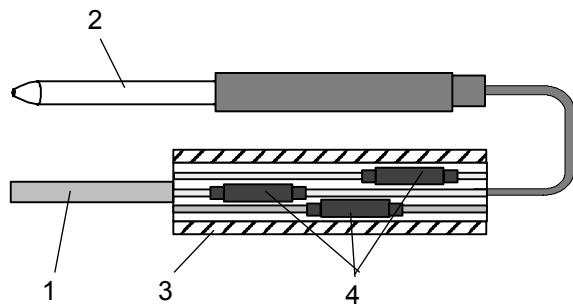
- Cut cable. Slide the cap and grommet off a bulb type sensor and save for reuse. **Do not cut the grommet.**
- Cut one wire of existing cable 40 mm (1-1/2 inches) shorter than the other wire.
- Cut replacement sensor wires (opposite colors) back 40 mm (1-1/2 inches). (See [Figure 7.17](#).)

Figure 7.17 Sensor Types



- Sensor
- 40 mm (1 1/2 in), 2 or 3 wires as required
- 6.3 mm (1/4 in).
- Strip back insulation on all wiring 6.3 mm (1/4 inch).
- Slide a large piece of heat shrink tubing over the cable, and place the two small pieces of heat shrink tubing, one over each wire, before adding crimp fittings as shown in [Figure 7.18](#).

Figure 7.18 Sensor and Cable Splice



- If required, slide the cap and grommet assembly onto the replacement sensor.
- Slip crimp fittings over dressed wires (keeping wire colors together). Make sure wires are pushed into crimp fittings as far as possible and crimp with crimping tool.
- Solder spliced wires with a 60% tin and 40% lead Rosincore solder.
- Slide heat shrink tubing over each splice so that ends of tubing cover both ends of crimp as shown in [Figure 7.18](#).
- Heat tubing to shrink over splice. Make sure all seams are sealed tightly against the wiring to prevent moisture seepage.

⚠️ CAUTION

Do not allow moisture to enter wire splice area as this may affect sensor resistance.

- Slide large heat shrink tubing over both splices and shrink.
- Position sensor in unit as shown in [Figure 7.18](#) and re-check sensor resistance:
[Figure 7.17 - Return Sensor Positioning](#)
[Figure 7.19 - Supply Sensor Positioning](#)
[Figure 7.21 - ETS Sensor Positioning](#)
- Reinstall sensor, refer to:
[Section 7.24.3 - For STS and SRS Re-Installation](#)
[Section 7.24.4 - For RRS and RTS Re-Installation](#)
[Section 7.24.5 - For DTS Re-Installation](#)
[Section 7.24.6 - For ETS1 and ETS2 Re-Installation](#)

NOTE

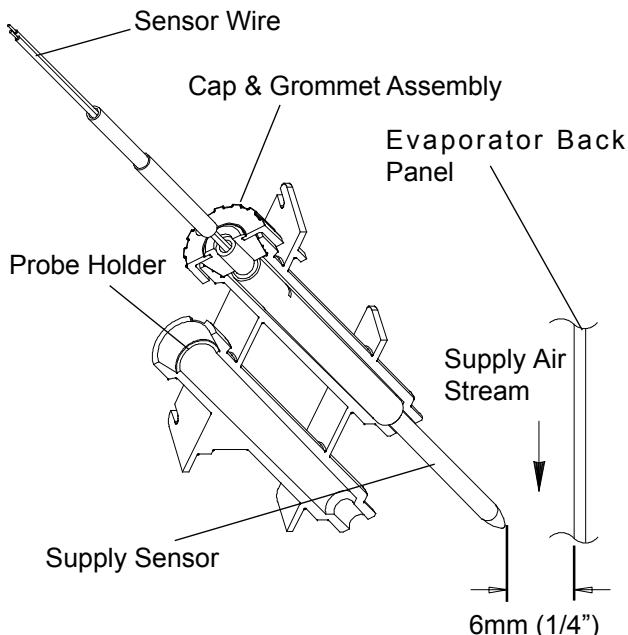
The P5 Pre-Trip test must be run to deactivate probe alarms (refer to [Section 5.8](#)).

7.24.3 Sensors STS and SRS Re-Installation

To properly position a unit supply sensor (Supply Temperature Sensor STS or Supply Recorder Sensor SRS), the sensor must be fully inserted into the probe holder. This positioning will give the sensor the optimum amount of exposure to the supply air stream, and will allow the Controller to operate correctly. Insufficient probe insertion into the probe holder will result in poor temperature control due to the lack of air flow over the sensor.

It is also necessary to ensure that the probe tip does not contact the back panel. The design minimum clearance of 6 mm (1/4 inch) should be maintained (see [Figure 7.19](#)).

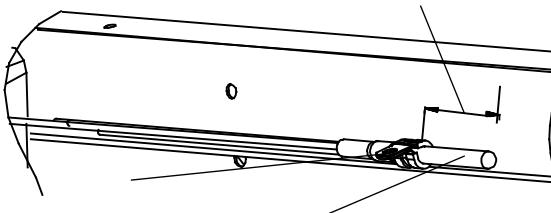
Figure 7.19 Supply Sensor Positioning



7.24.4 Sensors RRS and RTS Re-Installation

Reinstall the return sensor (Return Temperature Sensor RTS or Return Recorder Sensor RRS), as shown in [Figure 7.20](#). For proper placement of the return sensor, be sure to position the enlarged positioning section of the sensor against the side of the mounting clamp.

Figure 7.20 Return Sensor Positioning



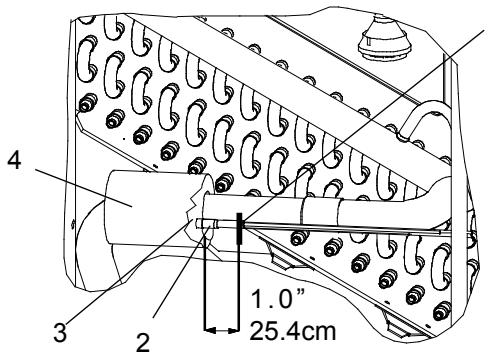
7.24.5 Sensor DTS Re-Installation

The Defrost Temperature Sensor (DTS) must have insulating material placed completely over the sensor to ensure the coil metal temperature is sensed.

7.24.6 Sensors ETS1 and ETS2 Re-Installation

The Evaporator Temperature Sensors, ETS1 and ETS2 are located in a tube holder under insulation, as illustrated in [Figure 7.21](#). When the combo sensor is removed and reinstalled, it must be placed in a tube holder by applying thermal grease. Insulating material must completely cover the sensor to ensure the correct temperature is sensed.

Figure 7.21 Evaporator Temperature Sensor Positioning



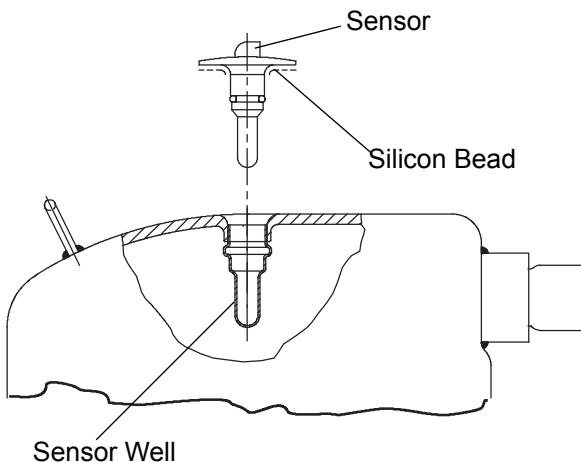
1. Wire Tie
2. ETS1 and ETS 2
3. ETS Tube Holder
4. Insulation

7.24.7 Sensor, CPDS Re-Installation

To replace the Compressor Discharge Temperature Sensor, see [Figure 7.22](#):

1. Ensure the unit is disconnected from the power source and that ST is in OFF position.
2. Remove the existing sensor. Clean all silicone sealer and dielectric compound from the sensor well. Ensure well is clean and dry. The top of the compressor, where the sensor seals, must also be clean and dry.

Figure 7.22 Compressor Discharge Temperature Sensor



3. Using the syringe supplied with the replacement sensor, squeeze all of the dielectric compound into the sensor well.
4. Place a bead of the silicone sealer supplied with the replacement sensor around the sensor sealing ring. Insert sensor into the well with the leads parallel to the suction fitting.
5. Reconnect the sensor (see [Figure 7.18](#)) and run Pre-trip P5.

7.25 VENT POSITION SENSOR (VPS)

The vent position sensor (VPS) determines the position of the fresh air vent in near real-time via the Cd55.

The fresh air vent position sensor alarm (AL50) will occur if the sensor reading is not stable for four minutes or if the sensor is outside of its valid range (shorted or open). This can occur if the vent is loose or the panel is defective. To confirm a defective panel, assure that the wing nut is secure and then power cycle the unit. If the alarm immediately reappears as active, the panel should be replaced.

The alarm should immediately go inactive, check the 4-minute stability requirement. If the alarm reoccurs after the four minutes and the panel was known to have been stable, then the sensor should be replaced.

Upper VPS:

In order to replace the Upper VPS, the panel must be removed and replaced with another upper fresh air panel equipped with VPS.

Upon installation, a new VPS assembly requires calibration as follows:

1. Rotate the vent to the 0 CMH/ CFM position.

2. Cd45 will automatically display. Press the Enter key and hold for five seconds.
3. After the enter key has been pressed the display will read CAL (for calibration).
4. Press the ALT MODE key and hold for five seconds.
5. After the calibration has been completed, Cd45 will display 0 CMH / CFM.

7.26 EAUTOFRESH SERVICE

7.26.1 Servicing the eAutoFresh Air Filter

Removing the Air Sample Filter Element

The air sample filter element can be accessed in two ways:

1. Through the eAutoFresh side evaporator access panel.
2. Through the inside of the container by lowering the upper evaporator panel.
 - a. By hand, unscrew and remove the filter cup from the bottom of the air sample filter assembly.
 - b. Remove the filter element from the filter assembly.
 - c. Install the new air sample filter element by reversing the above steps.

7.26.2 Checking eAutoFresh Drive System

Checking the Auto Slide:

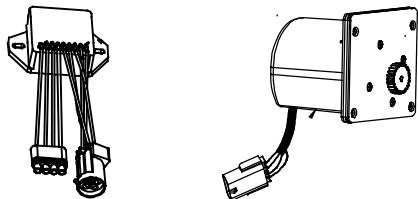
- a. To check with an ohmmeter, disconnect the four pin connector to the stepper motor. With a reliable digital ohmmeter, check the winding resistance. In normal ambient, the motor should have 72 to 84 ohms measured on the red/green (a-b terminals) and on the white/black (c-d terminals) leads. If an infinite or zero reading occurs, check connections or replace the motor. If near normal or normal reading occurs, proceed to the following sections to check out the controller.
- b. To check with a SMA- 12 portable stepper drive tester. The SMA- 12 portable stepper drive tester (Carrier Transicold P/N 07- 00375- 00) is a battery operated stepper drive which will open and close the auto slide, which allows a more thorough check of the motor.

Checking the Slide Motor:

- a. Turn unit OFF.
- b. Disconnect the four pin connector from the Stepper Drive to the Stepper Motor, (see [Figure 7.23](#)).

Figure 7.23 Stepper Components

Stepper Drive (SD) Stepper Motor (AF_)



- c. Attach the SMA-12 portable stepper drive tester to the Stepper Motor.
- d. Set the SMA-12 pulse per second (PPS) to one PPS and press button to open or close the valve. Each LED should light sequentially until all four are lit. If an LED fails to light, it indicates an open on that leg caused by a poor connection or an open coil. Repair or replace as required to achieve proper operation.
- e. Set the SMA-12 step rate to 200 PPS. Press open or close while watching the slide mechanism for movement, this is an indication that the motor is working.
- f. If the slide moves using the SMA- 12, but fails to move when connected in the unit (refer to "Checking the Drive Module" in the section that follows.)

Checking the Drive Module:

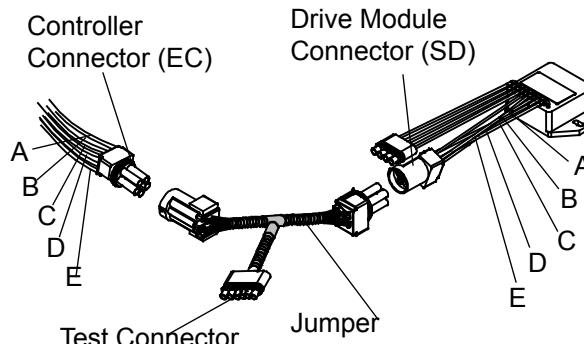
- a. Turn unit OFF.
- b. Disconnect the four pin connector to the Stepper Motor.
- c. With a voltmeter set to read 24 volts AC, attach the positive lead to the drive module outlet pin A (wire 1A) of the four pin connector and the negative lead to the B pin (wire 1B).
- d. Turn ON unit, and watch the volt meter. After a short delay, the reading should rise to approximately 12 volts.
- e. Repeat for pins C and D (wires 2A and 2B).\\
- f. If only one set of pins reads a voltage, check connections and retest.
- g. If the retest reads out the same, the drive module or controller is faulty.
- h. If no voltage is present in any step, the output from the controller to the drive module may be faulty. Check the connections and wires from the controller to the drive module.

- i. To replace the drive module, disconnect all connectors, unscrew from mounting, and replace with a NEW drive module in reverse order.

7.26.3 Checking the Controller

- a. Turn the unit OFF.
- b. Disconnect the six pin connector to the stepper drive from the controller.
- c. With a voltmeter set to read 50 volts DC, attach the positive lead to outlet pin A of the six pin connector, and the negative lead to pin B or TP-9 of the controller.
- d. Turn ON the unit for 40 seconds, and watch the voltmeter. There should be approximately 24 to 32 VDC shown on pin A.
- e. There should be zero volts on pin B.
- f. After a short delay, the reading should rise to approximately 24 to 32 VDC on pin E.
- g. Pins C and D will have zero to 5 volts transistor logic (TTL) signals present, however, this can only be checked with the connector assembled as this is an open collector type circuit. Checking the outputs on A, B and E will verify that the controller is supplying power to the drive module. To be thorough, and if it is desired, the signals on pins C and D can be checked as follows:
- h. Install a jumper assembly (Carrier part number 07- 00408- 00) to connect the drive module and controller connectors as shown in **Figure 7.24**.
- i. Connect the positive lead of the voltmeter to test connector socket C and negative lead to socket B, and run as before by resetting unit.
- j. Repeat for sockets D and B.

Figure 7.24 Jumper Assembly



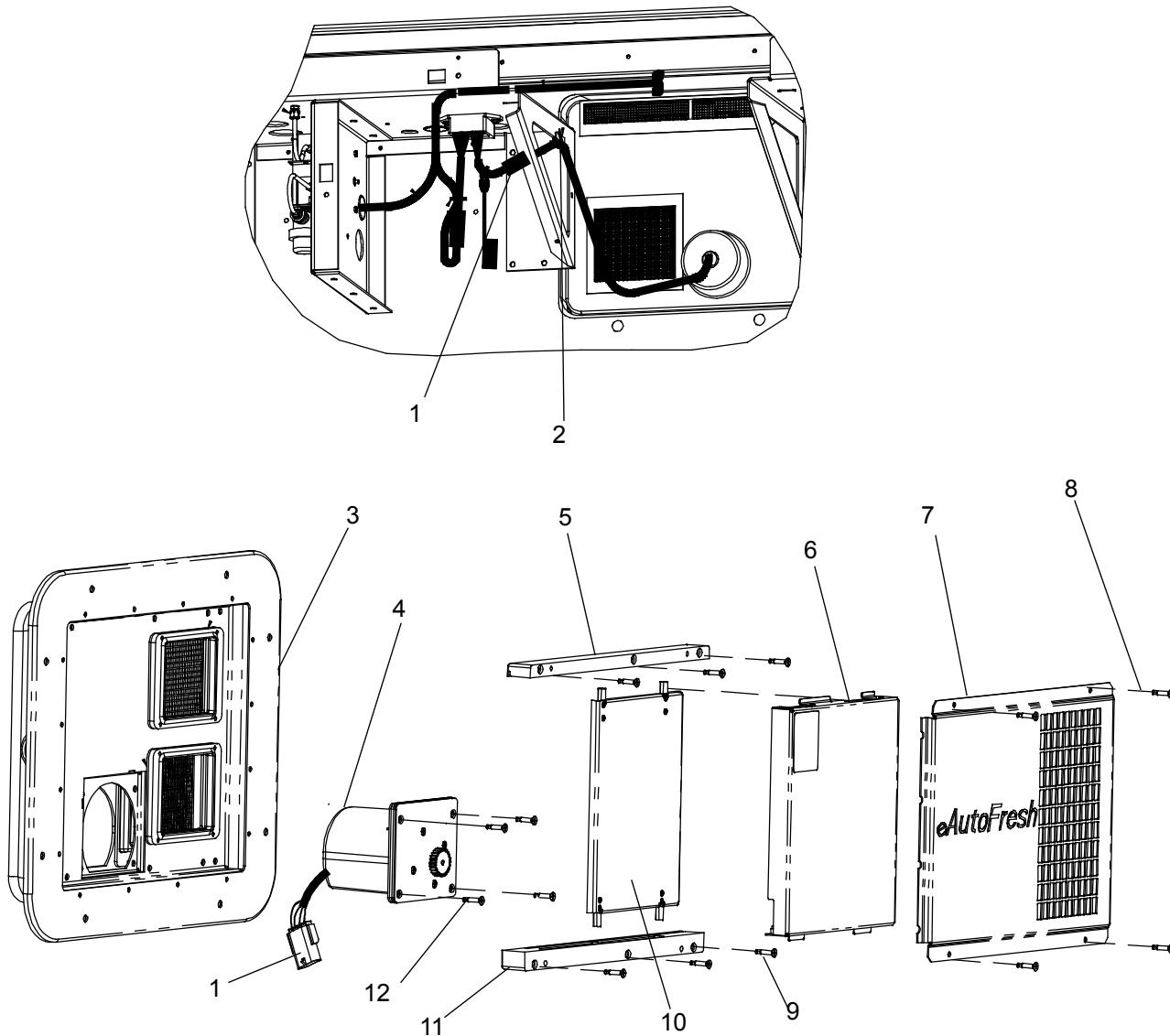
There should be approximately five volts DC on sockets "C" and "D" (S1 and S2) when measured as above. If not the connections or controller is faulty. If any of these pins are not consistent, the connections or the controller is suspect. Check and replace as required.

7.26.4 Servicing the eAutoFresh Drive System

To replace the Drive Motor Assembly:

- a. Remove the bolts that secure the eAutoFresh Panel (3, [Figure 7.25](#)) to the front of the unit. Reach in, cut tie wrap, (2) and disconnect the motor connector (1). Bring panel to work area.
- b. Remove four screws (8) fastening the grille (7).
- c. Remove six screws (9) fastening the rails (5 and 11), the slide plate (10) and the gasket plate (6). Set components aside for reassembly.
- d. Remove the four screws (12) fastening the motor cup (4) to the panel. Cut sealer on outside and inside of motor cup assembly. Push out the motor cup assembly from the rear of the panel.
- e. Mount the replacement motor cup assembly in the panel using original screws. Torque screws to 0.29 mkg (25 +/- 1 Inch pounds).
- f. Reapply sealer to the inside and the outside of the motor cup assembly.
- g. Mount the upper & lower rails, slide plate and gasket plate using original hardware. Apply thread sealant and torque screws to 0.29 mkg (25 +/- 1 Inch pounds).
- h. Mount grille assembly using original hardware. Apply thread sealant and torque screws to 0.29mkg (25 +/- 1 Inch pounds).
- i. Reconnect the motor connector.
- j. Replace the bolts that secure the eAutoFresh Panel to the front of the unit.
- k. Carry out functional test. Refer to [Section 5.4.3](#) step c.

Figure 7.25 Motor Cup Replacement



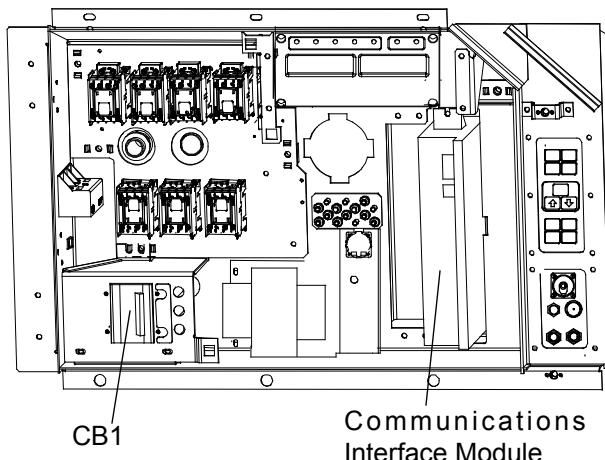
1. Connector
2. Tie Wrap
3. eAutoFresh Panel
4. Cup, Motor
5. Rail, Top
6. Plate, Gasket
7. Grille
8. Grill Screws
9. Rail Screws
10. Plate, Slide
11. Rail, Bottom
12. Motor Cup Screws

7.27 MAINTENANCE OF PAINTED SURFACES

The refrigeration unit is protected by a special paint system against the corrosive atmosphere in which it normally operates. However, should the paint system be damaged, the base metal can corrode. In order to protect the refrigeration unit from the highly corrosive sea atmosphere, or if the protective paint system is scratched or damaged, clean the area to bare metal using a wire brush, emery paper or equivalent cleaning method. Immediately following cleaning, apply paint to the area, and allow to dry. Refer to the Parts List for proper paint selection.

7.28 COMMUNICATIONS INTERFACE MODULE INSTALLATION

Figure 7.26 Communications Interface Installation



Units that have been factory provisioned for installation of a Communication Interface Module (CIM) have the required wiring installed. If the unit is not factory provisioned, a provision wiring kit (Carrier Transicold part number 76-00685-00) must be installed. Installation instructions are packaged with the kit.

To install the module:

WARNING

Installation requires wiring to the main unit circuit breaker, CB1. Make sure the power to the unit is off and power plug disconnected before beginning installation.

- a. CB1 is connected to the power system, see wiring schematic. Ensure that the unit power is off AND that the unit power plug is disconnected.
- b. Open control box, (see **Figure 7.26**) and remove low voltage shield. Open high voltage shield.
- c. If using factory provisioned wiring, remove the circuit breaker panel, with circuit breaker, from the control box. Locate, wires CB21/CIA3, CB22/CIA5 and CB23/CIA7 that have been tied back in the wire harness. Remove the protective heat shrink from the ends of the wires.
- d. Refit the circuit breaker panel.
- e. Fit the new CIM into the unit.
- f. Attach three wires CB21/CIA3, CB22/CIA5 and CB23/CIA7 to the CIM at connection CIA.
- g. Locate connectors CIA and CIB, remove plugs if required, and attach to the module.
- h. Replace the low voltage shield.

Table 7-4 R-134a Temperature - Pressure Chart

Temperature		Vacuum			
F	C	"/hg	cm/hg	kg/cm ²	bar
-40	-40	14.6	49.4	37.08	0.49
-35	-37	12.3	41.6	31.25	0.42
-30	-34	9.7	32.8	24.64	0.33
-25	-32	6.7	22.7	17.00	0.23
-20	-29	3.5	11.9	8.89	0.12
-18	-28	2.1	7.1	5.33	0.07
-16	-27	0.6	2.0	1.52	0.02
Temperature		Pressure			
F	C	psig	kPa	kg/cm ²	bar
-14	-26	0.4	1.1	0.03	0.03
-12	-24	1.2	8.3	0.08	0.08
-10	-23	2.0	13.8	0.14	0.14
-8	-22	2.9	20.0	0.20	0.20
-6	-21	3.7	25.5	0.26	0.26

Table 7-4 R-134a Temperature - Pressure Chart

Temperature		Vacuum			
-4	-20	4.6	31.7	0.32	0.32
-2	-19	5.6	36.6	0.39	0.39
0	-18	6.5	44.8	0.46	0.45
2	-17	7.6	52.4	0.53	0.52
4	-16	8.6	59.3	0.60	0.59
6	-14	9.7	66.9	0.68	0.67
8	-13	10.8	74.5	0.76	0.74
10	-12	12.0	82.7	0.84	0.83
12	-11	13.2	91.0	0.93	0.91
14	-10	14.5	100.0	1.02	1.00
16	-9	15.8	108.9	1.11	1.09
18	-8	17.1	117.9	1.20	1.18
20	-7	18.5	127.6	1.30	1.28
22	-6	19.9	137.2	1.40	1.37
24	-4	21.4	147.6	1.50	1.48
26	-3	22.9	157.9	1.61	1.58
28	-2	24.5	168.9	1.72	1.69
30	-1	26.1	180.0	1.84	1.80
32	0	27.8	191.7	1.95	1.92
34	1	29.6	204.1	2.08	2.04
36	2	31.3	215.8	2.20	2.16
38	3	33.2	228.9	2.33	2.29
40	4	35.1	242.0	2.47	2.42
45	7	40.1	276.5	2.82	2.76
50	1	45.5	313.7	3.20	3.14
55	13	51.2	353.0	3.60	3.53
60	16	57.4	395.8	4.04	3.96
65	18	64.1	441.0	4.51	4.42
70	21	71.1	490.2	5.00	4.90
75	24	78.7	542.6	5.53	5.43
80	27	86.7	597.8	6.10	5.98
85	29	95.3	657.1	6.70	6.57
90	32	104.3	719.1	7.33	7.19
95	35	1114.0	786.0	8.01	7.86
100	38	124.2	856.4	8.73	8.56
105	41	135.0	930.8	9.49	9.31
110	43	146.4	1009	10.29	10.09
115	46	158.4	1092	11.14	10.92

Table 7-4 R-134a Temperature - Pressure Chart

Temperature		Vacuum			
120	49	171.2	1180	12.04	11.80
125	52	184.6	1273	12.98	12.73
130	54	198.7	1370	13.97	13.70
135	57	213.6	1473	15.02	14.73
140	60	229.2	1580	16.11	15.80
145	63	245.6	1693	17.27	16.93
150	66	262.9	1813	18.48	18.13
155	68	281.1	1938	19.76	19.37

Table 7-5 Recommended Bolt Torque Values

BOLT DIA.	THREADS	TORQUE	Nm
FREE SPINNING			
#4	40	5.2 in-lbs	0.6
#6	32	9.6 in-lbs	1.1
#8	32	20 in-lbs	2.0
#10	24	23 in-lbs	2.5
1/4	20	75 in-lbs	8.4
5/16	18	11 ft-lbs	15
3/8	16	20 ft-lbs	28
7/16	14	31 ft-lbs	42
1/2	13	43 ft-lbs	59
9/16	12	57 ft-lbs	78
5/8	11	92 ft-lbs	127
3/4	10	124 ft-lbs	171
NONFREE SPINNING (LOCKNUTS ETC.)			
1/4	20	82.5 in-lbs	9.3
5/16	18	145.2 in-lbs	16.4
3/8	16	22.0 ft-lbs	23
7/16	14	34.1 ft-lbs	47
1/2	13	47.3 ft-lbs	65
9/16	12	62.7 ft-lbs	86
5/8	11	101.2 ft-lbs	139
3/4	10	136.4 ft-lbs	188

SECTION 8

ELECTRICAL WIRING SCHEMATIC AND DIAGRAMS

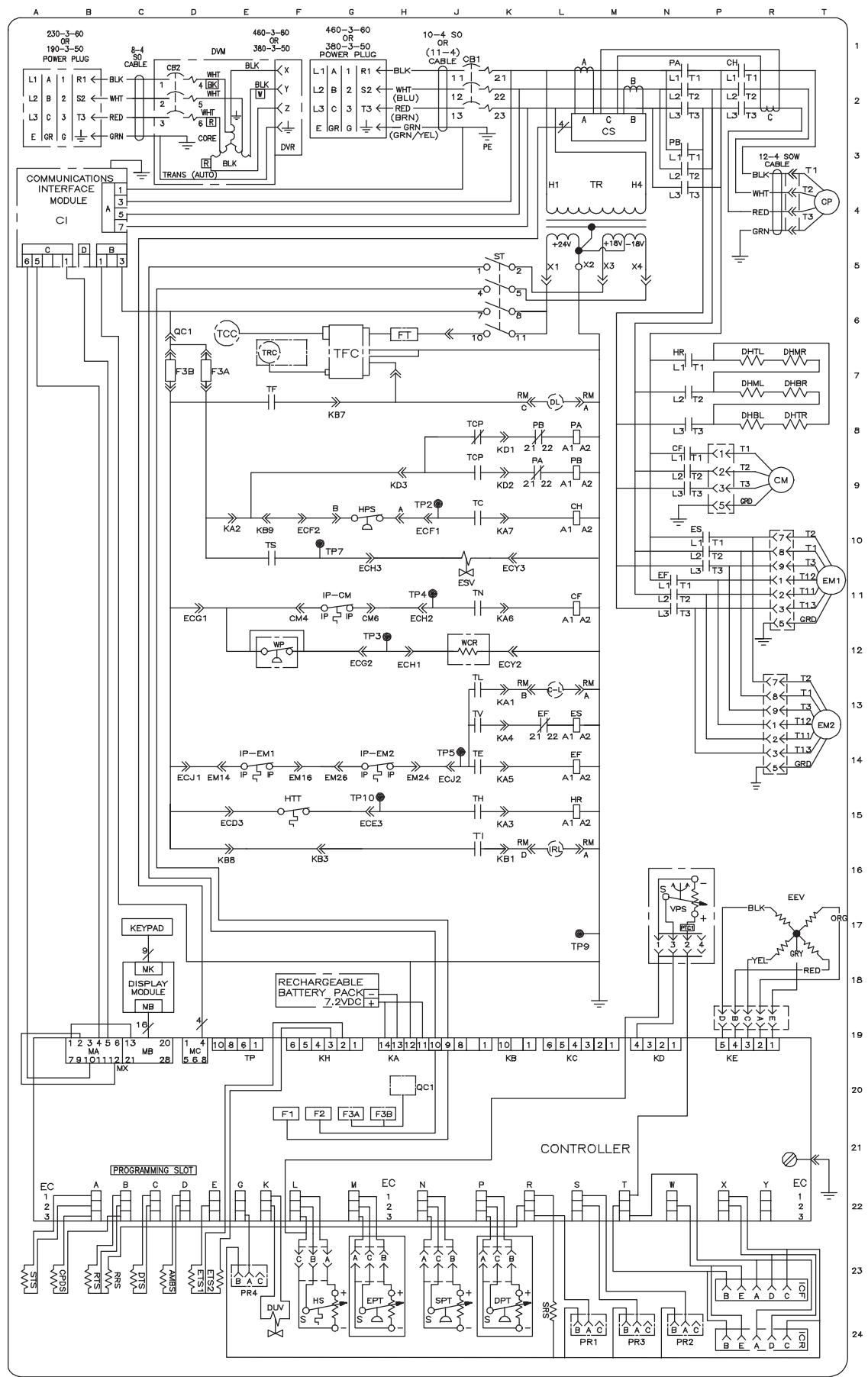
8.1 INTRODUCTION

This section contains the Electrical Schematics and Wiring Diagrams.

Figure 8.1 LEGEND - Standard Unit Configuration

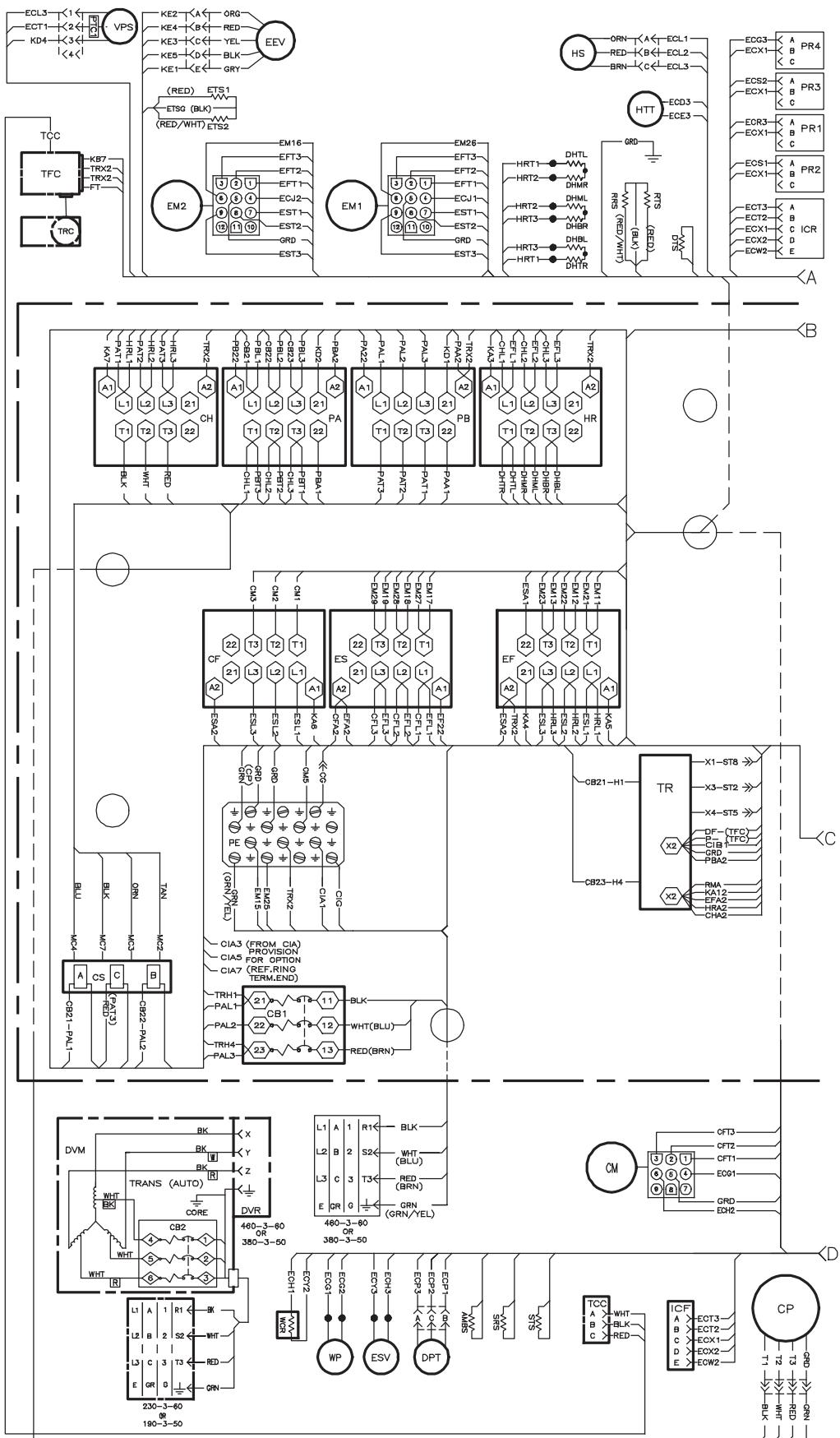
<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>SYMBOL</u>	<u>DESCRIPTION</u>
AMBS	AMBIENT SENSOR (C- 23)	HS	HUMIDITY SENSOR (OPTIONAL) (F- 23)
C	CONTROLLER (L- 21)	HTT	HEAT TERMINATION THERMOSTAT (E- 15)
CB1	CIRCUIT BREAKER - 460 VOLT (J- 1)	ICF	INTERROGATOR CONNECTOR FRONT (T- 23)
CB2	OPTIONAL CIRCUIT BREAKER - DVM (OPTION) (D- 1) TERMINAL BLOCK WHEN CB2 NOT PRESENT	ICR	INTERROGATOR CONNECTOR REAR (T- 24)
CF	CONDENSER FAN CONTACTOR (N- 8, L- 11)	IP	INTERNAL PROTECTOR (E- 14, F- 11, G- 14)
CH	COMPRESSOR CONTACTOR (L- 10, P- 1)	IRL	IN RANGE LIGHT (OPTION) (K- 15)
CI	COMMUNICATIONS INTERFACE MODULE (OPTION) (A- 4)	PA	UNIT PHASE CONTACTOR (K- 9, L- 8, N- 1)
CL	COOL LIGHT (OPTION) (L- 12)	PB	UNIT PHASE CONTACTOR (K- 8, L- 9, N- 3)
CM	CONDENSER FAN MOTOR (E- 11, G- 11, R- 9)	PR	USDA PROBE RECEPTACLE (M- 24, N- 24, P- 24)
CP	COMPRESSOR MOTOR (T- 4)	PTC	PTC FOR VENT POSITIONING SENSOR (N- 17)
CPDS	DISCHARGE TEMPERATURE SENSOR (A- 23)	RM	REMOTE MONITORING RECEPTACLE (OPTION) (K- 7, L- 7, K- 12, L- 12, K- 15, L- 15)
CS	CURRENT SENSOR (M- 2)	RRS	RETURN RECORDER SENSOR (C- 23)
DHBL	DEFROST HEATER - BOTTOM LEFT (R- 8)	RTS	RETURN TEMPERATURE SENSOR (B- 23)
DHBR	DEFROST HEATER - BOTTOM RIGHT (T- 7)	SPT	SUCTION PRESSURE TRANSDUCER (H- 23)
DHML	DEFROST HEATER - MIDDLE LEFT (R- 7)	SRS	SUPPLY RECORDER SENSOR (L- 23)
DHMR	DEFROST HEATER - MIDDLE RIGHT (T- 7)	ST	START - STOP SWITCH (K- 5)
DHTL	DEFROST HEATER - TOP LEFT (R- 7)	STS	SUPPLY TEMPERATURE SENSOR (A- 23)
DHTR	DEFROST HEATER - TOP RIGHT (T- 8)	TC	CONTROLLER RELAY- COOLING (J- 9)
DL	DEFROST LIGHT (OPTION) (L- 7)	TCC	TRANSFRESH COMMUNICATIONS CONNECTOR (OPTION) (D- 6)
DPT	DISCHARGE PRESSURE TRANSDUCER (K- 23)	TCP	CONTROLLER RELAY - PHASE SEQUENCING (J- 8, J- 9)
DTS	DEFROST TEMPERATURE SENSOR (C- 23)	TE	CONTROLLER RELAY - HIGH SPEED EVAPORATOR FANS (J- 14)
DUV	DIGITAL UNLOADER VALVE (F- 24)	TH	CONTROLLER RELAY - HEATING (J- 15)
DVM	DUAL VOLTAGE MODULE (OPTIONAL) (D- 1)	TF	CONTROLLER RELAY - DEFROST (E- 7)
DVR	DUAL VOLTAGE RECEPTACLE (OPTIONAL) (F- 3)	TI	IN- RANGE RELAY (J- 15)
EEV	ELECTRONIC EXPANSION VALVE (R- 16)	TL	CONTROLLER RELAY - COOL LIGHT (J- 12)
EF	EVAPORATOR FAN CONTACTOR- HIGH SPEED (N- 11, K- 13)	TN	CONTROLLER RELAY - CONDENSER FAN (J- 11)
EM	EVAPORATOR FAN MOTOR (T- 11, T- 13, E- 14, F- 14, G- 14)	TP	TEST POINT (H- 9, F- 10, H- 11, G- 12, H- 13, G- 15, L- 17)
EPT	EVAPORATOR PRESSURE TRANSDUCER (H- 23)	TR	TRANSFORMER (M- 3)
ES	EVAPORATOR FAN CONTACTOR- LOW SPEED (P- 10, L- 13)	TRANS	AUTO TRANSFORMER 230/460 (OPTION) (D- 3)
ETS	EVAPORATOR TEMPERATURE SENSOR (SUCTION) (D- 23)	TRC	TRANSFRESH REAR CONNECTOR (OPTION) (E- 7)
ESV	ECONOMIZER SOLENOID VALVE (J- 11)	TS	CONTROLLER RELAY - ECONOMIZER SOLENOID VALVE (E- 10)
F	FUSE (C- 7, D- 7, F- 21, G- 21)	TV	CONTROLLER RELAY - LOW SPEED EVAPORATOR FANS (J- 13)
FLA	FULL LOAD AMPS	VPS	VENT POSITION SENSOR (UPPER) (N- 17)
HPS	HIGH PRESSURE SWITCH (G- 9)	WCR	WETTING CURRENT RESISTOR (OPTION) (J- 12)
HR	HEATER CONTACTOR (N- 7, L- 15)	WP	WATER PRESSURE SWITCH (OPTION) (E- 12)

Figure 8.2 SCHEMATIC DIAGRAM

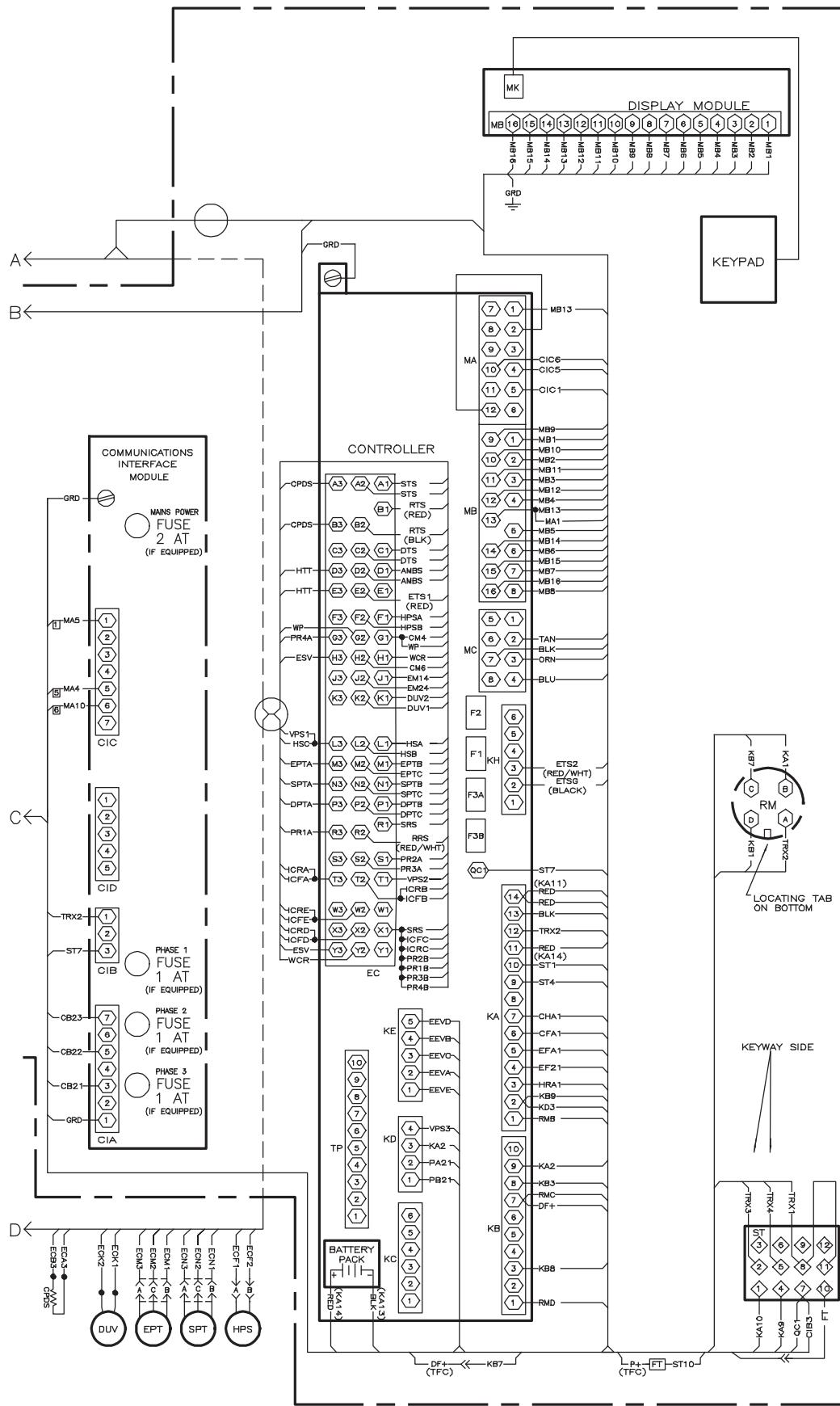


Based on Drawing 62-11737

Figure 8.3 UNIT WIRING DIAGRAM (Sheet 1 of 2)



Based on Drawing 62-11737



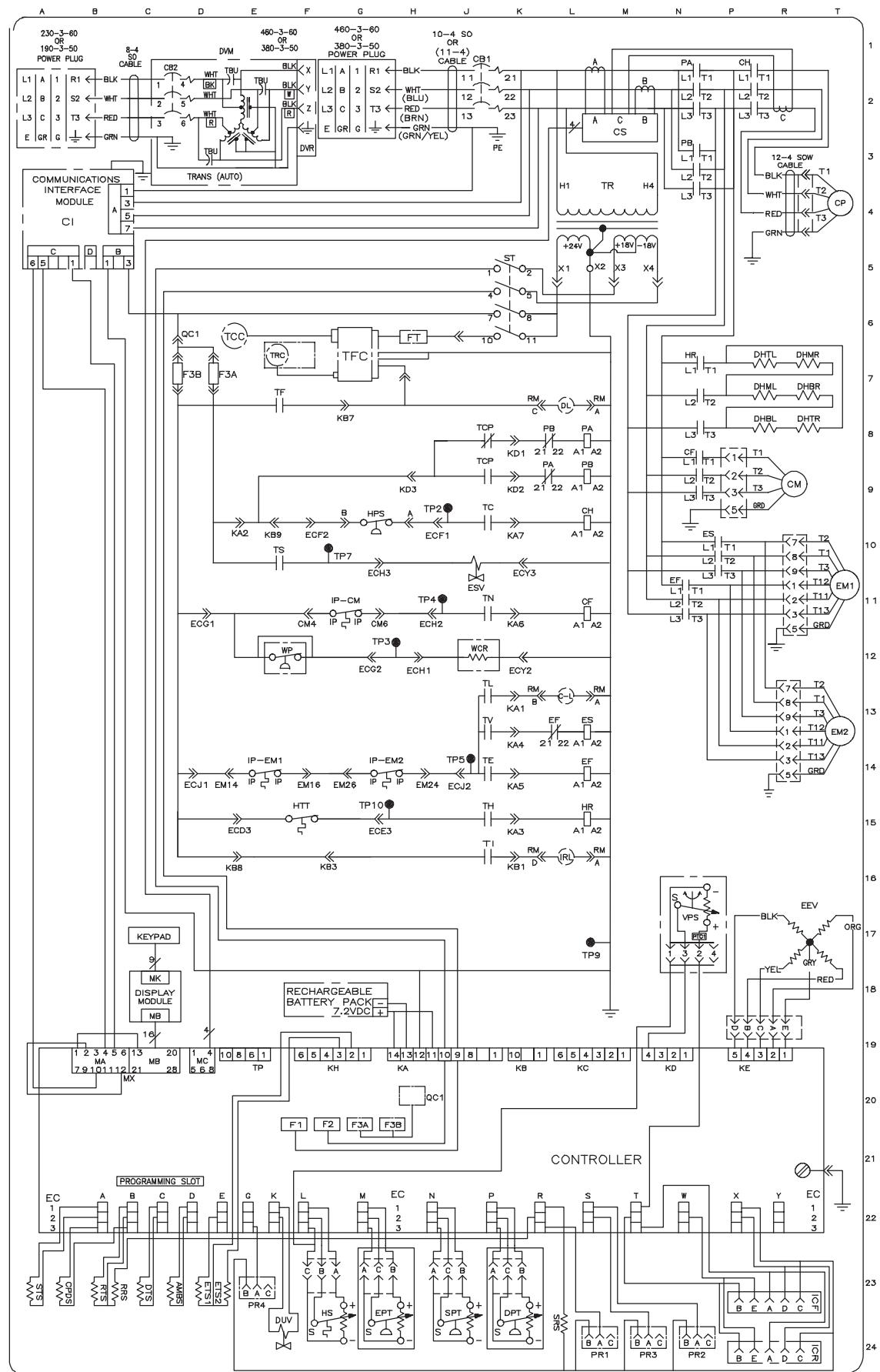
Based on Drawing 62-11737

Figure 8.4 LEGEND - Unit With Autotransformer

LEGEND

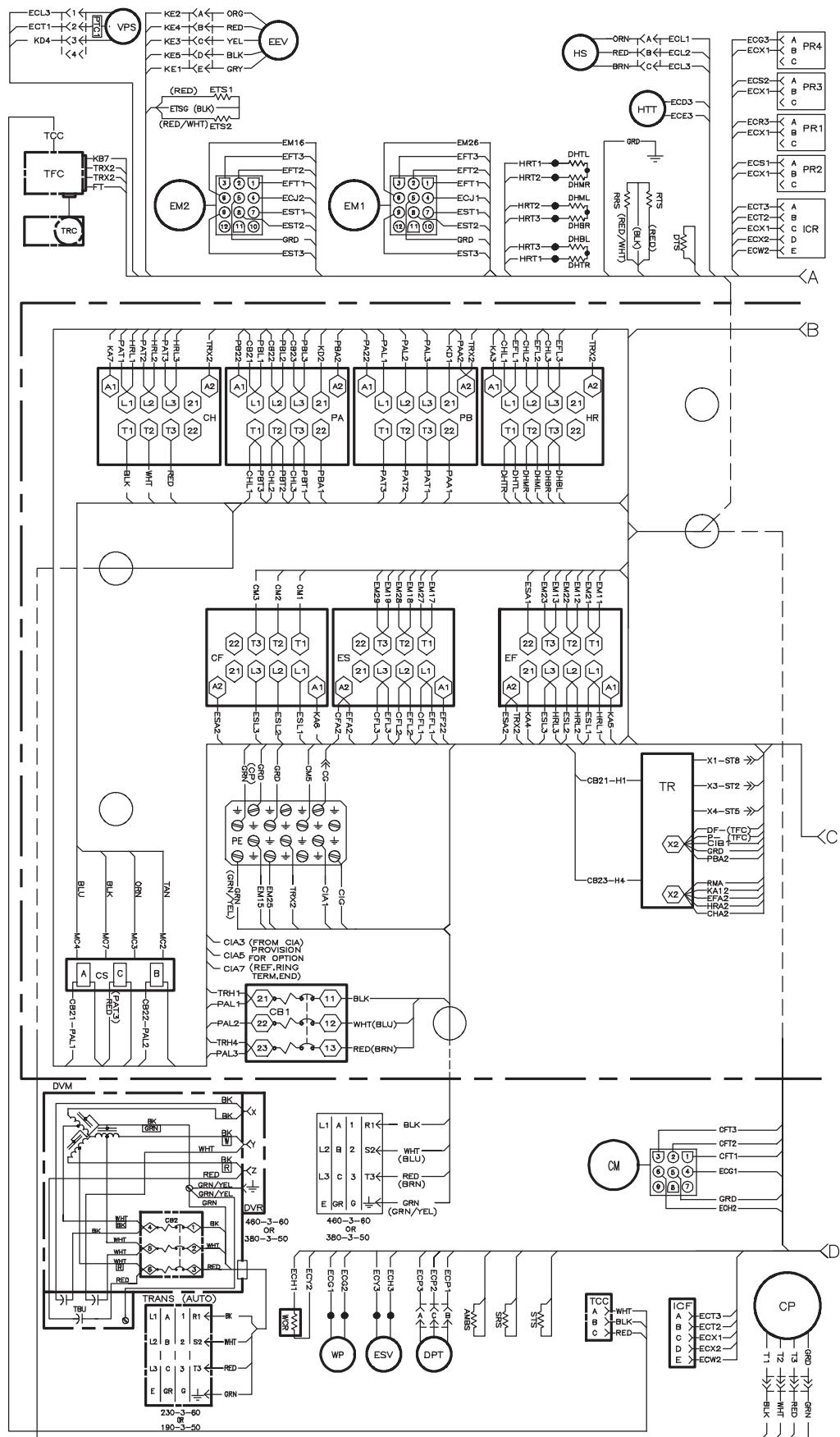
<u>SYMBOL</u>	<u>DESCRIPTION</u>	<u>SYMBOL</u>	<u>DESCRIPTION</u>
AMBS	AMBIENT SENSOR (C- 23)	HS	HUMIDITY SENSOR (OPTIONAL) (F- 23)
C	CONTROLLER (L- 21)	HTT	HEAT TERMINATION THERMOSTAT (E- 15)
CB1	CIRCUIT BREAKER - 460 VOLT (J- 1)	ICF	INTERROGATOR CONNECTOR FRONT (T- 23)
CB2	OPTIONAL CIRCUIT BREAKER - DVM (OPTION) (D- 1) TERMINAL BLOCK WHEN CB2 NOT PRESENT	ICR	INTERROGATOR CONNECTOR REAR (T- 24)
CF	CONDENSER FAN CONTACTOR (N- 8, L- 11)	IP	INTERNAL PROTECTOR (E- 14, F- 11, G- 14)
CH	COMPRESSOR CONTACTOR (L- 10, P- 1)	IRL	IN RANGE LIGHT (OPTION) (K- 15)
CI	COMMUNICATIONS INTERFACE MODULE (OPTION) (A- 4)	PA	UNIT PHASE CONTACTOR (K- 9, L- 8, N- 1)
CL	COOL LIGHT (OPTION) (L- 12)	PB	UNIT PHASE CONTACTOR (K- 8, L- 9, N- 3)
CM	CONDENSER FAN MOTOR (E- 11, G- 11, R- 9)	PR	USDA PROBE RECEPTACLE (M- 24, N- 24, P- 24)
CP	COMPRESSOR MOTOR (T- 4)	PTC	PTC FOR VENT POSITIONING SENSOR (N- 17)
CPDS	DISCHARGE TEMPERATURE SENSOR (A- 23)	RM	REMOTE MONITORING RECEPTACLE (OPTION) (K- 7, L- 7, K- 12, L- 12, K- 15, L- 15)
CS	CURRENT SENSOR (M- 2)	RRS	RETURN RECORDER SENSOR (C- 23)
DHBL	DEFROST HEATER - BOTTOM LEFT (R- 8)	RTS	RETURN TEMPERATURE SENSOR (B- 23)
DHBR	DEFROST HEATER - BOTTOM RIGHT (T- 7)	SPT	SUCTION PRESSURE TRANSDUCER (H- 23)
DHML	DEFROST HEATER - MIDDLE LEFT (R- 7)	SRS	SUPPLY RECORDER SENSOR (L- 23)
DHMR	DEFROST HEATER - MIDDLE RIGHT (T- 7)	ST	START - STOP SWITCH (K- 5)
DHTL	DEFROST HEATER - TOP LEFT (R- 7)	STS	SUPPLY TEMPERATURE SENSOR (A- 23)
DHTR	DEFROST HEATER - TOP RIGHT (T- 8)	TBU	TRANSFORMER BRIDGING UNIT (D- 1, D- 2)
DL	DEFROST LIGHT (OPTION) (L- 7)	TC	CONTROLLER RELAY- COOLING (J- 9)
DPT	DISCHARGE PRESSURE TRANSDUCER (K- 23)	TCC	TRANSFRESH COMMUNICATIONS CONNECTOR (OPTION) (D- 6)
DTS	DEFROST TEMPERATURE SENSOR (C- 23)	TCP	CONTROLLER RELAY - PHASE SEQUENCING (J- 8, J- 9)
DUV	DIGITAL UNLOADER VALVE (F- 24)	TE	CONTROLLER RELAY - HIGH SPEED EVAPORATOR FANS (J- 14)
DVM	DUAL VOLTAGE MODULE (OPTIONAL) (D- 1)	TH	CONTROLLER RELAY - HEATING (J- 15)
DVR	DUAL VOLTAGE RECEPTACLE (OPTIONAL) (F- 3)	TF	CONTROLLER RELAY - DEFROST (E- 7)
EEV	ELECTRONIC EXPANSION VALVE (R- 16)	TI	IN- RANGE RELAY (J- 15)
EF	EVAPORATOR FAN CONTACTOR-HIGH SPEED (N- 11, K- 13)	TL	CONTROLLER RELAY - COOL LIGHT (J- 12)
EM	EVAPORATOR FAN MOTOR (T- 11, T- 13, E- 14, F- 14, G- 14)	TN	CONTROLLER RELAY - CONDENSER FAN (J- 11)
EPT	EVAPORATOR PRESSURE TRANSDUCER (H- 23)	TP	TEST POINT (H- 9, F- 10, H- 11, G- 12, H- 13, G- 15, L- 17)
ES	EVAPORATOR FAN CONTACTOR-LOW SPEED (P- 10, L- 13)	TR	TRANSFORMER (M- 3)
ETS	EVAPORATOR TEMPERATURE SENSOR (SUCTION) (D- 23)	TRANS	AUTO TRANSFORMER 230/460 (OPTION) (D- 3)
ESV	ECONOMIZER SOLENOID VALVE (J- 11)	TRC	TRANSFRESH REAR CONNECTOR (OPTION) (E- 7)
F	FUSE (C- 7, D- 7, F- 21, G- 21)	TS	CONTROLLER RELAY - ECONOMIZER SOLENOID VALVE (E- 10)
FLA	FULL LOAD AMPS	TV	CONTROLLER RELAY - LOW SPEED EVAPORATOR FANS (J- 13)
HPS	HIGH PRESSURE SWITCH (G- 9)	VPS	VENT POSITION SENSOR (UPPER) (N- 17)
HR	HEATER CONTACTOR (N- 7, L- 15)	WCR	WETTING CURRENT RESISTOR (OPTION) (J- 12)
		WP	WATER PRESSURE SWITCH (OPTION) (E- 12)

Figure 8.5 SCHEMATIC DIAGRAM, Unit With Autotransformer

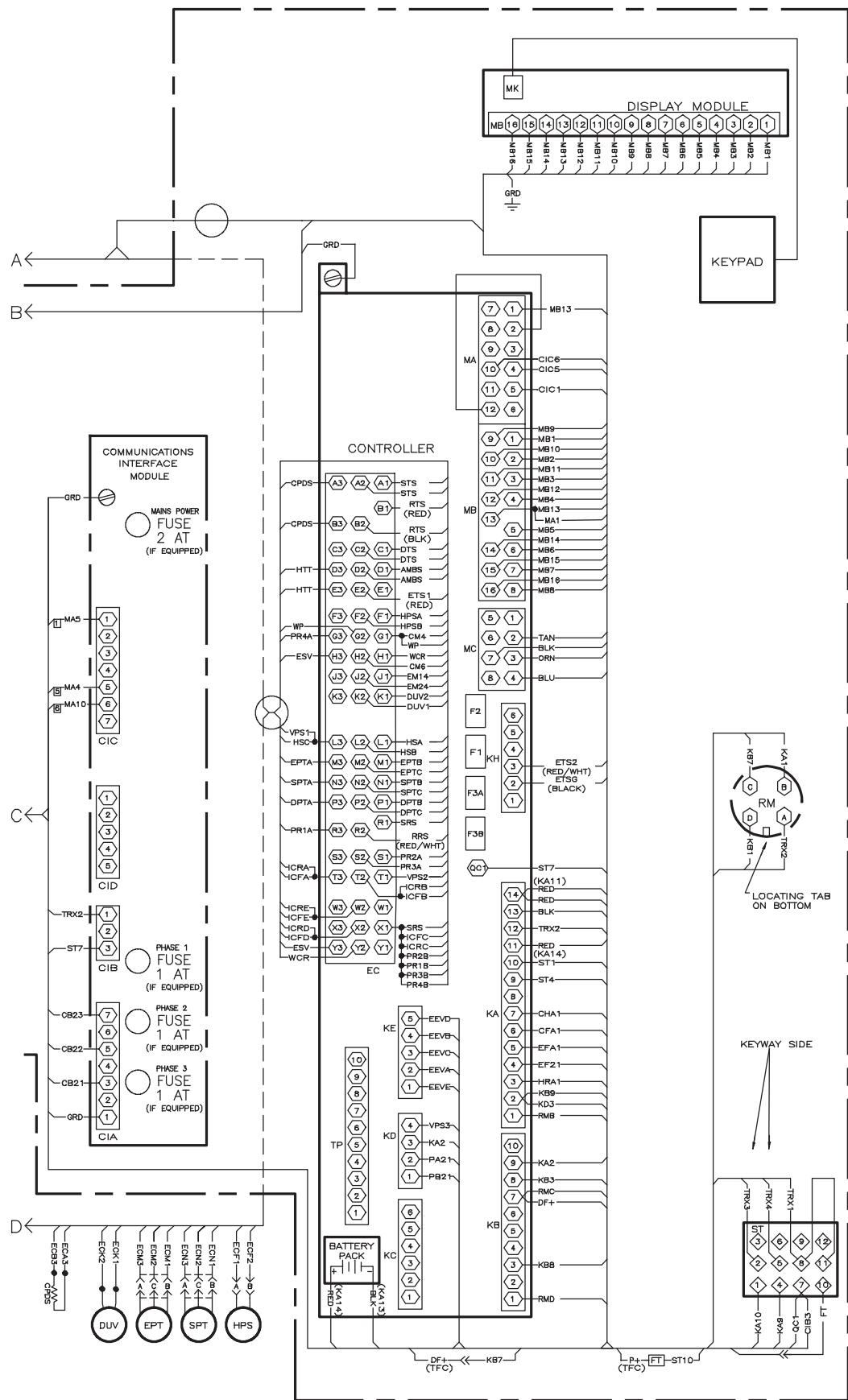


Based on Drawing 62-66088

Figure 8.6 UNIT WIRING DIAGRAM, Unit With Autotransformer (Sheet 1 of 2)



Based on Drawing 62- 11737



Based on Drawing 62-11737

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